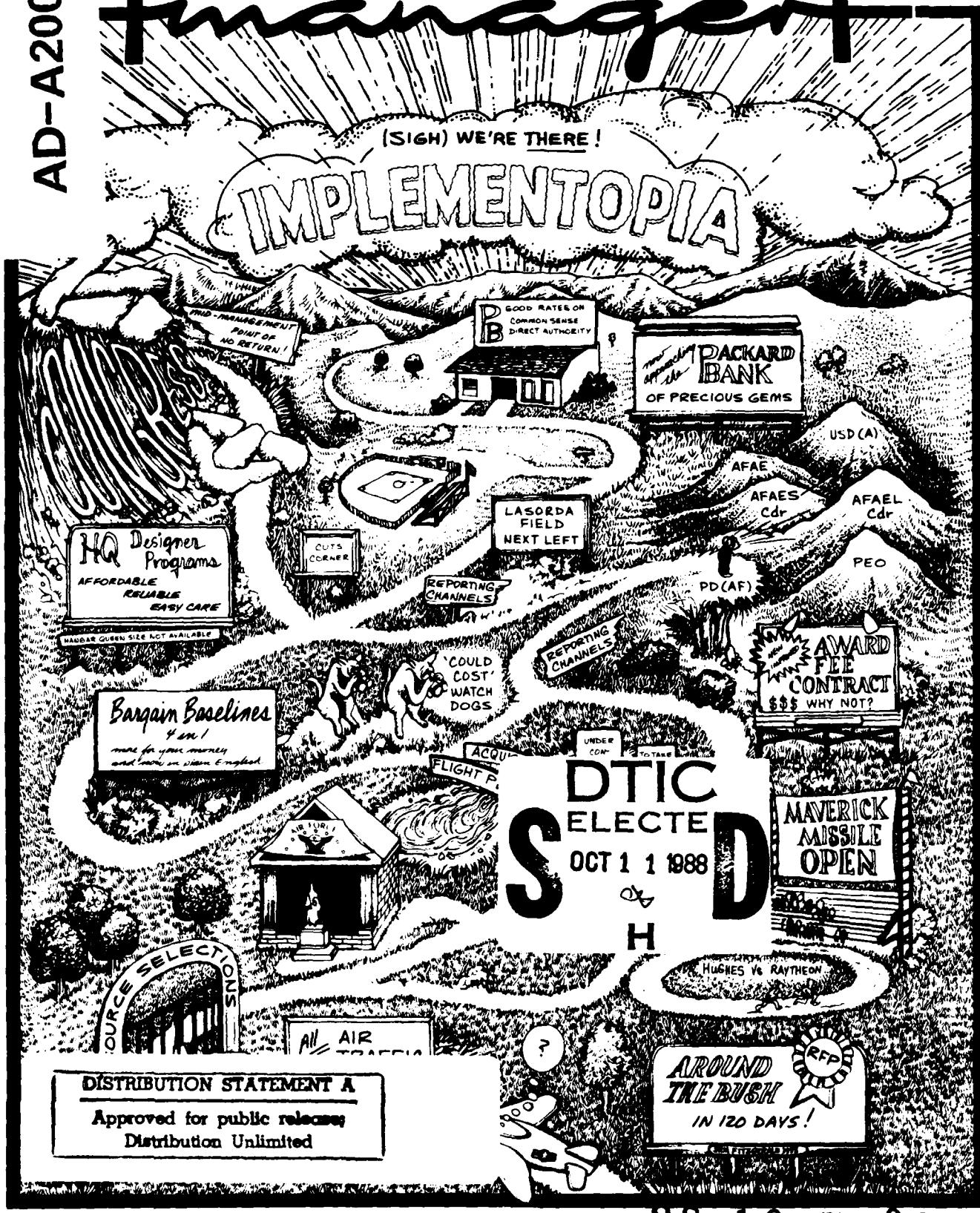


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Journal of the Defense

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2

Air Force Acquisition: Toward the Direct Route

*Bernard P. Randolph,
General, USAF*

A focus on procurement practices, decision-making and reporting channels, and people.

14

Setting Priorities for the Nation's Defense

*The Honorable Frank C.
Carlucci*

The Secretary of Defense addresses the need to retain an effective and ready fighting force.

9

A Layman's Tutorial on Authorization and Consent

Robert L. Aram

A simple explanation of a complex subject.

12

Ethics in the Eighties Revisited

David D. Acker

Continuation of a popular series prompted by positive and supportive comments from readers.

10

Adjusting for Price Level Changes with Raw and Weighted Inflation Indices

*Jane Robbins
Richard Murphy*

Methodology used, how and why.

S y s t e m s M a n a g e m e n t C o l l e g e

27
28

**PMC 88-3 Hears About
Acquisition Logistics
Phases**

*Stanley R. Arthur
Vice Admiral, USN*

Program management is a highly integrated set of tasks.

29

**Joint Service/Joint
Venture:
A Management
Challenge**

Captain A. E. Victor, USN

Providing a common self-protection jammer system for Navy and Air Force tactical aircraft—lessons learned.

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AIR FORCE ACQUISITION: TOWARD THE DIRECT ROUTE

General Bernard P. Randolph, USAF



This is taken from remarks made by General Randolph, Commander, Air Force Systems Command, at the 50th annual news conference, Aviation/Space Writers Association, Boston, Mass., May 1988.

from Requests for Proposal release to award announcement was 114 days, better than our goal of 120 days. The MLV II is the first time we applied the new past performance criteria to selection of a contractor.

I've looked forward to the chance to talk about what is going on in the Air Force acquisition system in the post-Packard era. The winds of change whipped through the acquisition arena since the Packard Commission issued its call for change 2 years ago. I will focus on three areas that were affected: procurement practices (now streamlined); decision-making and reporting channels (shorter and to the point); and people (still tops in their fields, but fewer in number and better trained).

Streamlining

Source selections are streamlined now. My command's goal is to reduce the number of days to 120 from release of Requests for Proposal to award decision. That involves cutting down the number of pages allowed in proposals, the number of areas evaluated and the size of the source selection teams. My people are working to slim down the Requests for Proposals we send to industry.

In the first quarter of this year, Systems Command made 15 contract awards, all with restrictions on page limits for contractors' proposals. Thirteen of the 15 proposals that had technical volumes averaged 82 pages. Although these weren't high-dollar procurements—the average value was \$15 million—82 pages for technical content is a quantum decrease compared to the old days.

Among upcoming competitions, the Medium Launch Vehicle II (MLV II) selection typified the streamlined process. We limited people involved to 40, and the time lapse

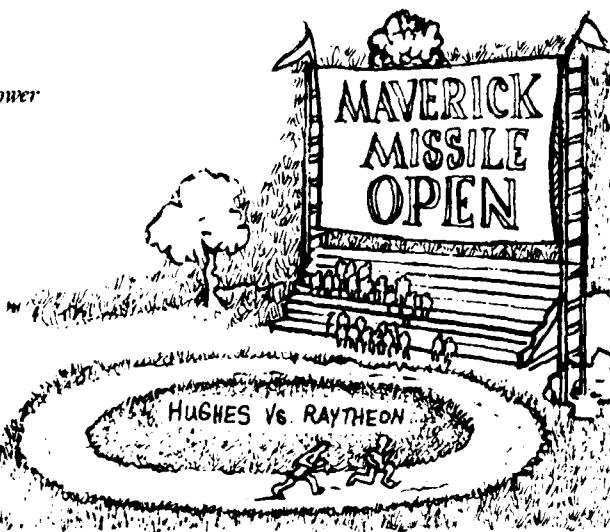
Past Performance

Until now, the military didn't rely too heavily on past performance evaluations; but, the "hit and run" approach doesn't make sense. Past performance will be a key factor in our source selections from now on. This initiative implements a Packard Commission finding, uses a well-founded commercial practice that prime contractors employ in their vendor rating systems, and recognizes good performers. The idea is to take a systematic look at contractors' past performance as a risk consideration. Just as we assign technical risk to a contractor's proposal in source selection, we'll now assign performance risk based on a company's track record on past contracts.

The MLV II program is a test case for past performance; the C-17 Aircrew Training System is another. We filed a proposed rule in the *Federal Register* on March 23 to try to institutionalize the use of past performance in source selections. Comments are coming in, and we can accommodate them. In my talks with defense contractors, they agree in principle, and want to make sure that if a regulation results, it's fair and reasonable. So does the Air Force.

I would note that past performance figures high in commercial practice. Take the auto industry. Manufacturers deal only with quality suppliers, and track records make or break vendors. The government has different rules, some mandated by law, like the competition in contracting act. Sometimes we don't have the leeway to stay with suppliers but, insofar as we can, we will consider past performance in future awards.

The trophies? Lower costs and larger quantities.



Competition

Since the Competition In Contracting Act passed in 1984, Air Force Systems Command has seen a steady and dramatic increase in competitive obligations, which grew from 26 percent in '84 to 56.7 percent last year. Translated, that's a jump from \$6.2 billion obligated competitively in '84 to \$14.5 billion last year. Because statistics for those obligations are driven by high-dollar programs like the B-1B, F-16, and F-15, consider another indicator of the relative health in the competition area, competitive actions. From '84 to '87, they rose from 75 percent to 90 percent.

What does the Air Force get in return? Stronger warranties, an expanded industrial base, technological innovations, better prices and larger quantities. The last two are illustrated by the 1986 Maverick Missile production contract. We directed a split award of 1,525 to Hughes and 800 to Raytheon. In fiscal year 1987 we held the first year of head-to-head competition with Hughes, awarding Hughes 2,021 missiles and Raytheon 1,203. The fiscal year 1987 competition produced much lower costs than estimated. As a result, we were able to buy 3,224 missiles versus the expected 2,000 based on fiscal year 1987.

Funding—a 61 percent increase. Based on the fiscal year 1987 results, and availability of fiscal year 1988 funding, we estimated we could buy 2,360 Maverick Missiles this year. We ended up with 2,817. Competition was a major factor in the improvements—

most dramatic in 1987, of course, but still working for us in 1988 and beyond.

The combined effects munition (CEM) is another dual-source competition, between Honeywell and Aerojet. Fiscal year 1985 was a directed split award, but fiscal year 1986 and fiscal year 1987 were head-to-head competitions. The cost of CEM to the Air Force was reduced by 32 percent from fiscal year 1986 to fiscal year 1987, due to competition.

Competition, whether in production phases like Maverick or the CEM, or on new developments like the C-17, SRAM II or AMRAAM, pays big dividends. Clearly, the Services are not just giving lip service to competition. But it's not the religion some think it is for the Department of Defense. Whether to compete, qualify a second source, or go sole source is a judgment call. If competition will get the best deal for the Air Force and meet the combat commands' needs, we go for it. When limited quantities or return on investment prove that creating additional sources would cost more than we'd save through competition, [we go sole-source].

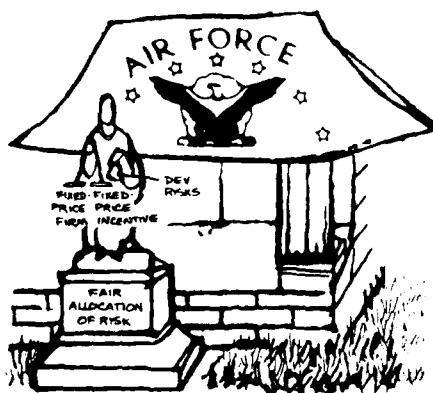
Fixed-Price-Type Contracts

On to a fourth contracting issue on the front burner—determination of contract type and use of fixed-price contracts. Let me make two things clear: one, it is not Air Force policy for contractors to fund our research and development projects by presenting them a contract that requires heavy

up-front development cost investment; two, the Advanced Tactical Fighter is not the model for all future Air Force acquisitions. Conversely, it is not our policy to set up "spend to win" competitions or fund industry ineptitude.

We judge each procurement on its own merit, and apply the appropriate acquisition techniques. News stories highlighted the fiscal year '88 Appropriations Act provision that puts administrative restrictions on fixed-price-type contracts involving \$10 million or more on major systems. They have to be approved at a high level in the Office of the Secretary of Defense. Senator Jeff Bingaman (D., N. M.) introduced a bill that would permanently codify the approval wickets.

The congressional intent is good—fair allocation of risk between contracting parties, same as the Air Force goal. This kind of detailed legislation takes the most basic responsibility of the contracting officer—determining the proper contract type—and puts it in the hands of the Congress. The Air Force has, in my experience, judiciously matched contracting types to programs. When development risks are not high, we do consider fixed-price-type contracts, but they're typically fixed-price incentive, not firm-fixed price. That means we share in the risk.



Weighing out the risk in matching contracting types to programs, the verdict is typically fixed-price incentive.

The use of positive incentives is compelling our attention.



Expanded Use of Positive Incentives

That brings me to contractor performance incentives. The contracting community has felt that much of what we do is of demotivating nature. I agree that positive incentives like award fee, productivity investments, or higher profits are better than such negative incentives as payments withheld and increased oversight to motivate acquisition excellence. I believe in paying more profit to reward better quality and lower costs.

The use of positive incentives, and award fee is compelling our attention. It is a contract type—a variation of cost plus or fixed-price. Award fee provides for a pool of money to be set aside and awarded based on the government assessment of how a contractor performs over and above what is minimally required in the statement of work. Some areas we're looking at are reduction of the total cost of quality; reliability improvements such as the on-orbit life of satellites or better mean time between failure than specified; and, new and innovative approaches to test programs.

Award fee is not new. We have used it in the DSCS program, the TITAN IV BOOSTER, most of our range operations and maintenance contracts, and other programs. What is new is that we are looking at institutionalizing it right from the start, making it part of the formal review of each acquisition plan developed by program directors. By the time program directors are at headquarters for acquisition strategy panels, they would address whether they are using award fee, or why they are not.

Acquisition Strategy Panels

Acquisition strategy panels (ASPs) are a recent innovation. We always had business strategy panels for some programs, where program directors

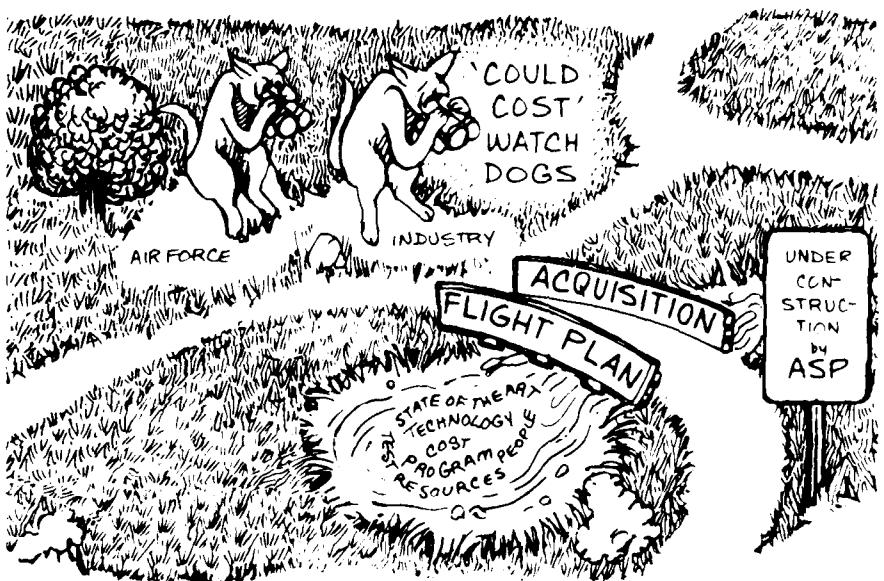
would review contracting strategies and legalities, warranties, and other business angles of their programs. Now, panels afford a total acquisition approach to all programs, applying lessons learned from the past. Before the launch of each phase of major programs, the director meets with a panel of experts on test, product assurance, computer engineering, competition, technology, comptroller, manpower, and others; they're from product divisions and headquarters, and the goal is to guarantee an executable plan. They scrutinize schedule, cost, technology state-of-the-art, people needed to work the program, test resources and all aspects.

There have been 10 Acquisition Strategy Panels since January, the most recent being the AWACS Radar Sensitivity Improvement Program, the Seek Spinner Drone, and the TITAN IV Alternate Launch facility. I at-

tended the TITAN IV Acquisition Strategy Panel where risk areas were flagged, contingencies examined, and ways to minimize them identified. This kind of preplanning is as important to an acquisition as a flight plan is to a flight.

Could Cost

I'll wrap up the subject of procurement streamlining with a few words on the new "could cost" initiative developed by Dr. Robert Costello, Under Secretary of Defense (Acquisition). Could cost seeks the contractor's cooperation in eliminating costs that don't add value to his work. It includes scrubbing weapon system requirements and specifications, reducing overhead, looking at the size of the marketing force, simplifying the contracting process, and examining and improving the manufacturing process. Could cost can yield real payoffs if we make it a team effort involving the Air Force and industry. The goal is the same driving force behind all our streamlining efforts: the best product at the lowest cost for the combat commands.



*Minimizing the mountains
of organizational wickets.*

Organizational Changes

Let me address corporate changes that were outcomes of the Packard Commission Report, which most people know; and, which have been institutionalized since 1987, which many people don't realize.

Reporting Channels

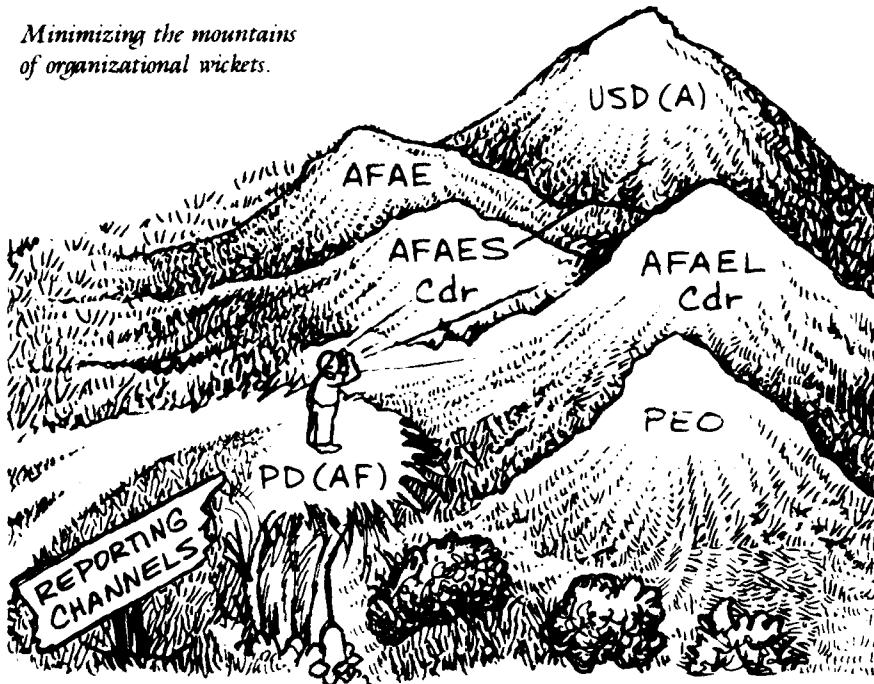
I believe in Norman Augustine's 13th law: "If a sufficient number of management layers are superimposed on top of each other, it can be assured that disaster is not left to chance." That's how the Packard Commission was thinking when it recommended that most reporting channels for Defense programs be eliminated. They have been. The key acquisition players today are the Undersecretary of Defense for Acquisition, Dr. Costello; The Service Acquisition Executive, Jack Welch; The Acquisition Commander- myself for Systems Command and General Al Hansen for Logistics Command; the Program Executive Officer (PEO), assigned by program; and the Program Director. Each has distinct and necessary roles.

In the post-Packard era, the system may not be perfect, but it is structured to give program directors minimal organizational wickets and enough authority, flexibility and resources to get the job done.

Baselines

Besides cleaner reporting channels another initiative to make life easier for program directors is streamlining baselines. A program baseline, is a contract signed by the user, developer, trainer and supporter that sets forth performance parameters, cost and when "rubber will hit the ramp."

Until now, four different baselines were required of each program: one by the Congress, one by the Department of Defense, one by the Air Force, and one by Air Force Systems Command. That is a waste of time and money. Systems Command has proposed one baseline per program, not to exceed 10 pages, and in plain English; we're making progress toward that goal.



The new baseline concept establishes thresholds based on where the program is in the acquisition cycle. Using an *ATF-Type Airplane* as an example, the program director must stay within 50 percent of the initial baseline cost estimate, stick to within 1 year of the schedule, and keep the Mach number within a given range when undertaking design tradeoffs. As we get into full-scale development, flexibility tightens up. When production starts, there are more constraints.

If a slip of even 2 months appears likely in production, the program director would be on the "hot seat" from highest levels of the Air Force.

Clearly, his or her object is to keep Tactical Air Command out of a bind by delivering the aircraft on time, and keep everyone out of a bind by inspiring confidence in the program.

We are not going to see overnight success in terms of trouble-free programs. Too many external factors bear on the acquisition cycle. The baseline is a solid management tool that limits instability and outlines the program director's authority to do the job. It is incentive to deliver a winner to operating commands. We'll be baselining all 359 major Air Force programs. The 35 biggest ticket programs have been done since January; the rest should be completed by this summer.

Cost and scheduling stick-to-it-iveness.



Headquarters Role

What is the headquarters role when using the new reporting system—the new baselines? It goes beyond resource allocation and oversight of 300-plus programs. Working with the Air Force Acquisition Executive, the Command provides tools, trained people, technology, and acquisition strategies to build the combat commands what they want and advocate. We're not advocates; we offer system options for executable programs and risk analyses for each. When a program hits a snag in cost, schedule and performance, system options provide alternatives to the user to get the program back on track. The goal of the systems engineering options process is timely delivery of affordable, effective systems that are easy to maintain. We're not just designing capability; we're *designing-in* reliability and maintainability.

The advanced tactical fighter is a good example of the iterative process we go through with the user. The program is baselined at \$35 million average unit fly-away cost, with a takeoff gross weight of 50,000 pounds for the design mission. In the first round of trades required to maintain the baseline—last fall—we found we were overweight, based on contrac-

tors' preferred concepts. Systems Command proposed to Tactical Air Command that we change the requirement to net a drop in weight by 5,000 pounds and a drop in cost—\$4 million a copy.

A word on ATF's supportability, since the best performing plane in the world isn't worth a hoot if it's a hangar queen. We're planning major reliability and maintainability improvements. I call them factors of two. Compared with current air-to-air fighters we want an airplane that's twice as reliable, one that will take half the maintenance man-hours per flying hour, one that will operate in combat with twice as many sorties per day, and one that we can move into the combat area using half the C-141 missions that we use today. That's what the user wants; providing for customers' wants is what the ATF program director, all program directors, and all Systems Command people, whatever their job, work toward.

People

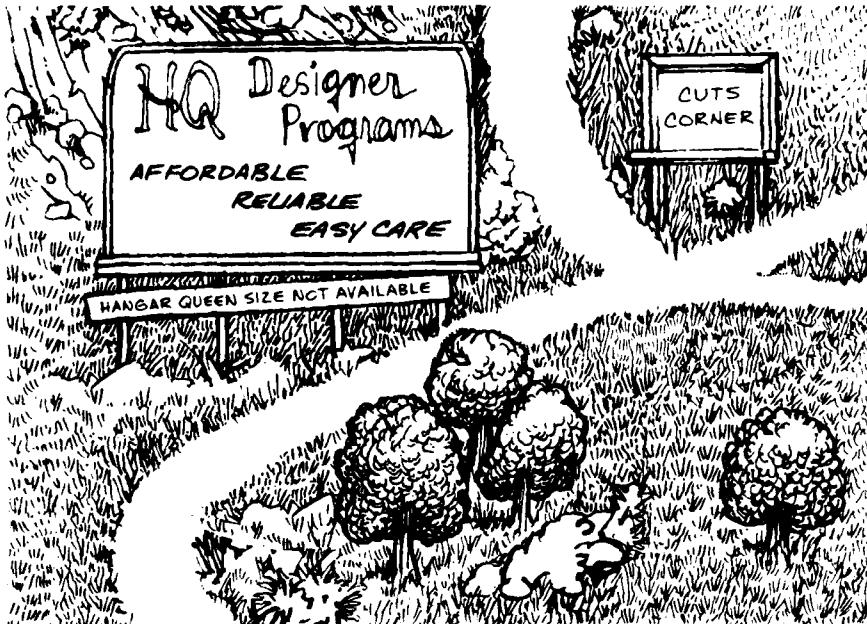
There are people out in front of and behind the scenes in the buying and building of weapon systems. They are fewer now. The headquarters especially is leaner and meaner than this time last year. We've cut the staff by 17

percent—7 percent more than the 10 percent Goldwater-Nichols requirement. Though our people are fewer in number, they are tops in skill and talent.

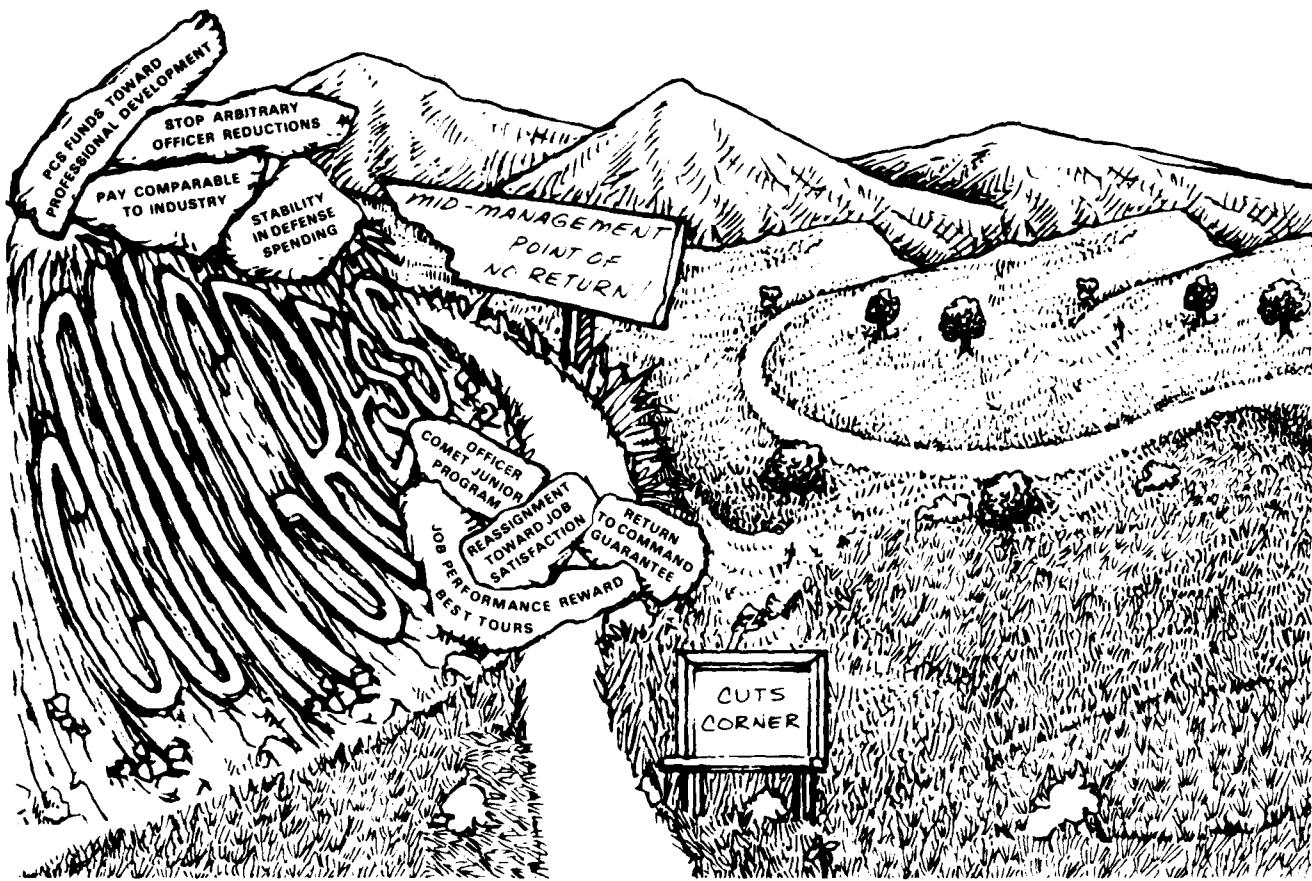
My senior people—leaders of today's acquisition team—have impressive track records. Many are combat pilots and veterans. My Vice Commander, Lieutenant General Sam Armstrong, who came over from Military Airlift Command, flew 100 missions over North Vietnam in F-105s. My Deputy for Systems, Major General (selectee) John Schoepfner, flew 151 in the F-105. My Deputy Chief of Staff for Test and Resources, Brigadier General Pete Winters, flew 298 F-100 missions. Major General Mike Loh, the next commander of Aeronautical Systems Division, flew 195 combat missions in Vietnam. Brigadier General Tom Ferguson, AMRAAM Program Director, flew B-52s the first time they were employed over the North; in fact, he flew the first mission against Mu Gia Pass. These are just a few of many. I maintain that the finest airplanes we ever built were at the end of the Vietnam conflict because our combat veterans came back to lead the acquisition process that built them.

Professional Development For Acquisition Managers

Young test pilots, engineers, contracting officers, and program managers are sharp, creative, and better trained; for instance, acquisition officers have gates now, like pilots. Our professional development model certifies them at four levels. It includes formal training like that offered at the Defense Systems Management College: program office tours, lab, AFPRO, or headquarters job. Since there is no substitute for operational experience, we look for flying or non-flying operations too—missiles, space, and munitions or aircraft maintenance. Actually, we have built a professional development plan that accommodates acquisition officers, test pilots and navigators, and operational pilots and NAVS. By the time someone is ready to manage a big-ticket item, he or she will have 8-10 years of acquisition experience in three different jobs, plus an operational tour.



Toward reliability and maintainability.



Loss of engineers, managers, and scientists — blocking the road.

Retention

One big problem is retention of "the best" as uncertainties mount: like pay caps, education funding, PCS cuts, officer reductions, program cuts, and promotion slowdowns. You are familiar with the Air Force pilot retention problem; there are also other retention problems with a particular impact on Systems Command. The cumulative continuation rates for our developmental engineers, program managers and scientists have declined dramatically. The continuation rate looks back 12 months at losses from the critical 4 to 11 year groups — our middle managers — and projects retention into the out years.

The cumulative continuation rate for engineers in Systems Command declined from a high of 62 percent in 1984 to 41 percent in fiscal year 1987, the lowest since fiscal year 79 when it was 36 percent. With more than 70 percent of Air Force Developmental engineers in the Command, we are concerned about the future; engineers are the backbone of the AFSC mission.

Since the mid-1980s, continuation rates for our program managers and scientists have seen similar declines. Program managers went from 66 to 46 percent, and scientists from 72 to 35 percent.

Retaining the best is a priority and a challenge in this austere environment. Historically, 25 percent of our officers leave after completing their initial obligations—at the grade of captain—but we have increasing losses of people with 5, 6, and 7 years of experience. They find job opportunities with industry after we have invested heavily in their professional development. Understandably, they want to avoid the insecurity that officer reductions and program cuts may have on their careers. Further, the engineers lost a bonus that was a big incentive in the mid-1980s.

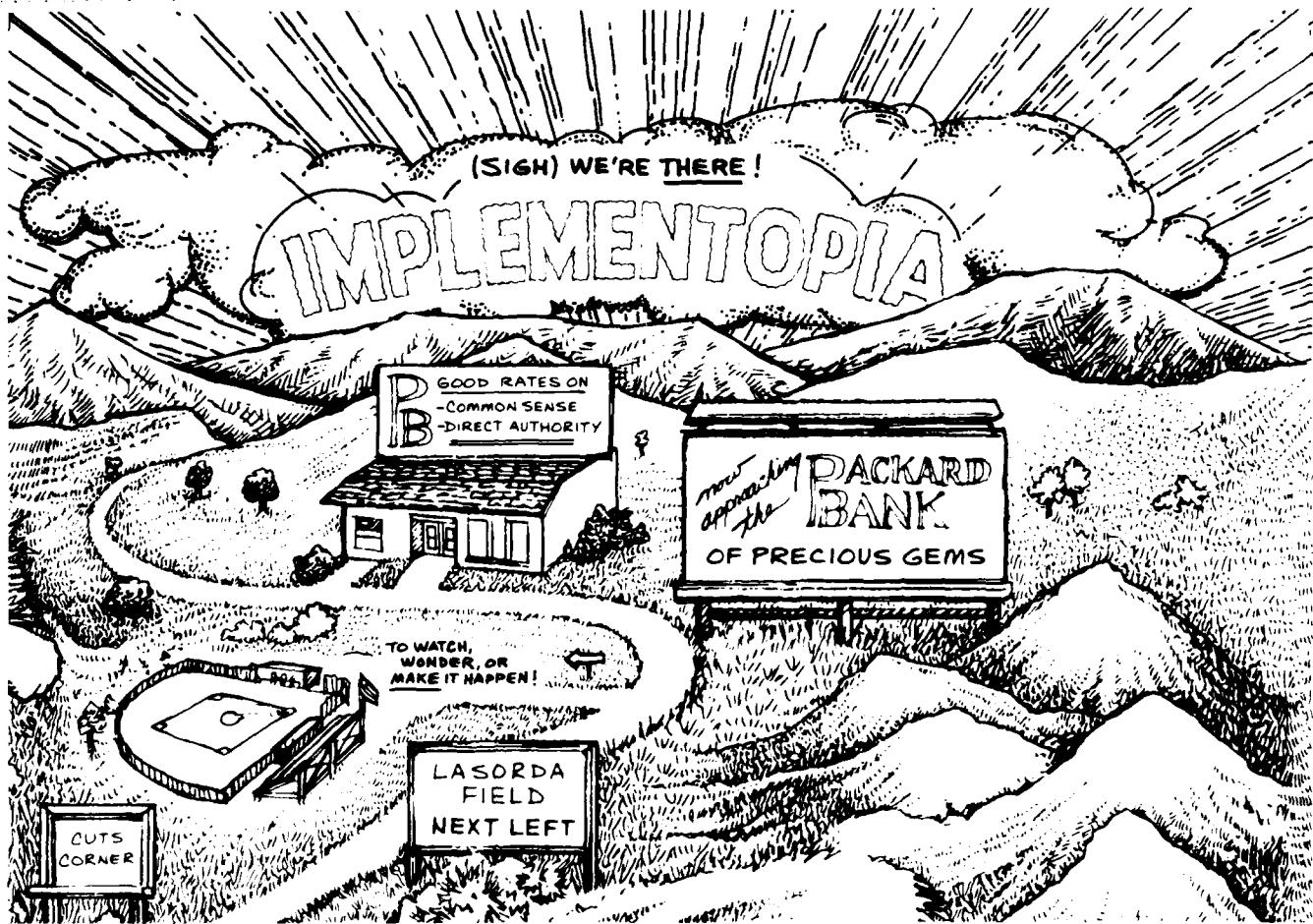
We can control some of the causes for dropping retention rates, like rewarding job performance rather than "square filling"; implementing "best" tours that permit officers to take operational assignments with a

guarantee of returning to the Command; and Command experience and training, or "comet" program, which allows junior officers to go on temporary duty to the flight line to see how their efforts matter to the combat commands. We support changes of assignment within a geographical area to enhance job satisfaction.

On the other hand, we have little control of other factors. We need the Congress' support for relief from arbitrary officer reductions; for pay increases comparable with the private sector; for permanent-change-of-station funding permitting moves to enhance professional development; and for stability in overall defense spending.

Conclusion

I have no doubt that elected officials, the press, the taxpayer and the military have identical expectations of the defense acquisition system: effective combat capability and value for the tax dollar. Maybe our views on how to get there differ, depending on



The goal of the Air Force System Command: to fix the course for the future.

our vantage point. That's why I think it is important to address what's happening today in Air Force acquisitions. There have been big changes in the post-Packard era—not suggested changes, or changes under consideration—but changes that have been implemented and are working.

Former Secretary of State Henry Kissinger was asked how difficult it was to make major policy decisions. He said *making* the decisions was *nothing* compared to getting them *implemented*. I'm glad to report that wasn't the case with implementation of the Packard acquisition-oriented actions. The Commission's 1986 final report, *A Quest for Excellence*, was a blueprint for action by the Department of Defense and the Congress, and a plan for coherent improvement of defense management. I can't speak for the legislative taskings, but in the acquisition arena it called for several things.

—Streamlining of organizations: It's done. The channels from program director to acquisition executive are alive and functioning;

—Simpler procedures: I have men-

tioned a few—we're using less paperwork, fewer people, and less time for the process of getting rubber on the ramp;

—Expanded competition: It's our strategy of choice;

—Training highly-qualified acquisition personnel: a priority in Air Force Systems Command, for all specialty fields.

I could continue, addressing what we've done in the areas of prototyping, use of commercial products, and other commission issues, but the point is this: We've made giant strides in meeting David Packard's goals, to "simplify the acquisition system by consolidating policy and oversight, reducing reporting chains, eliminating duplicative functions and excessive regulations, and establishing an environment in which program managers can operate as centers of excellence.

Tommy Lasorda, L.A. Dodgers Manager, said there are three kinds of baseball players (his categories apply to organizations). He observed: "There are those who make it happen, those who watch it happen, and those who wonder what happens." I believe Air

Force Systems Command and the team, Jack Welch's personnel, and Dr. Costello's staff, can make it happen.

The ability to deliver weapon systems that will keep fighting forces strong depends on a combination of factors. This includes a streamlined acquisition system and effective procurement strategies which are good and getting better. Also, we need stable and talented and bright people, whom we need to cultivate.

The Packard Commission sought to overcome those challenges by concluding: "Give people more authority to do their jobs. Make it possible for people to do the right thing the first time and allow them to use their common sense. When this is done, layers of supervision can be eliminated, reporting can be minimized, and DOD can get by with fewer people. Only then will productivity and quality become hallmarks of defense acquisition."

Our task, as President John F. Kennedy observed, is "not to fix the blame for the past, but to fix the course for the future." That's what we're doing at Air Force Systems Command.

A LAYMAN'S TUTORIAL ON AUTHORIZATION AND CONSENT

Robert L. Amm

In drafting a Point Paper I have encountered considerable difficulty in understanding and explaining patent law in general and the *Authorization and Consent* clause in particular. After studying this subject and explaining it to others, I have developed a simple explanation which also may be useful to you.

The Constitution

Patent law springs directly from the Constitution. Our founding fathers realized that invention and innovation, coupled with widespread dissemination of new and better ways to do things, were beneficial to society. To provide incentive for creative individuals to invent and disseminate new products and processes, they established patents in the Constitution.

Two-Way Street

A patent is a two-way agreement between inventor and government. The inventor publicly discloses the idea in the patent application, which is good for society because it disseminates knowledge of the new concept. In exchange, the government gives a monopoly privilege with the exclusive right to use and profit from the invention for a limited period of time (17 years). During that time, the government will protect monopoly privileges in the federal courts. After that, the idea becomes free for anyone to use.

Government Reserves Right to Infringe

Although the government grants monopoly privileges in exchange for the public benefit of disclosure, it reserves the right to use a patented invention for the public good. Thus, a patented idea may be used by the government without the inventor's permission, but not by anyone else, which use would constitute infringement. The government is not competing with the inventor or with the private sector, but performing for the public good. When government infringes a patent, the inventor is entitled to a fair and equitable royalty. This preserves the original incentive to invent and disclose new ideas.

Authorization and Consent

The government has the right to infringe a patent. Since the government does most of its business by contracting to the private sector, the government can delegate authority to infringe to a contractor working on behalf of the government. The authorization and consent clause placed in government solicitations and contracts effects this delegation. Under this clause, the government authorizes the contractor to use patents on behalf of the government, and consents to the patent holder suing the government for infringement rather than the contractor.

Indemnity

In order to prevent contractors from unfairly competing with the patent holder by using the invention at no cost to themselves, the government may include a patent indemnity clause in the contract. In this clause, the contractor agrees to reimburse (indemnify) the government for expenses the government may incur in paying royalties to the patent holder.

An indemnity clause is generally used when the supplies or services being procured are offered in the commercial open market. An indemnity clause is generally not used for work which is primarily research and development, or for items that clearly have not been offered in the open market.

Claims and Suits

Under an authorization and consent clause, the patent holder's only recourse is to seek payment of a royalty from the government. The patent holder not coming to terms with the government can sue the government in the Court of Claims, which will determine a fair and equitable royalty. The court will not award penalties or damages, only a fair and equitable royalty.

Under an authorization and consent clause, the patent holder cannot sue the contractor or obtain an injunction to stop the infringement.

Policy and Summary

Society benefits from innovation and dissemination of new ideas, and the government wants to benefit from new ideas. Thus, the government encourages the use of inventions in government contracts. This is true even if the invention is patented by someone other than the contractor. The authorization and consent clause is used to authorize a contractor to use patents.

Generally, when procuring commercial supplies or services, the government will pass the royalty cost on to the contractor by including an indemnity clause in the contract.

Caveat

This paper presents basic concepts of a complex subject. For specific guidance, see Federal Acquisition Regulation, Part 27, Patents, Data and Copyrights, or seek legal counsel.

Mr. Amm, Naval Avionics Center, Indianapolis, is project engineer for Ground Proximity Warning System and Naval Aircraft Collision Warning System.

ADJUSTING FOR PRICE LEVEL CHANGES WITH RAW AND WEIGHTED INFLATION INDICES

Jane Robbins

Richard Murphy

The objective of a cost estimate is to predict the cost of those resources required to perform a task at some time in the future. This means that the cost analyst must take into account the fact that prices differ at different points in time. Typically, the problem of price level changes and the problem of resource estimation are treated separately. When the analyst's data base represents actual expenditures, the effects of price level changes must first be removed so that the cost of all resources are expressed in dollars representing the same purchasing power. The analyst can then focus on the particular characteristics of the new program to develop a constant dollar estimate of resource requirements. This estimate must then be adjusted to reflect the actual prices that will be paid at the time the resources are acquired.

The process of adjusting costs, estimated or actual, for differences in price levels requires the use of inflation indices. In fact, there are rules that, if properly applied, allow the analyst to make whatever dollar conversions are necessary. Without knowing why these rules work, however, it is difficult for an analyst or a program manager to understand how these calculations adjust for the inflation that is affecting their program. Furthermore, an analyst who knows why the rules work is less likely to make mistakes when accounting for price level changes. Therefore, the objective of this article is to discuss the methodology for developing raw inflation indices and weighted inflation indices, and to illustrate how they should be used.

Construction of Raw Inflation Indices

Raw inflation indices are computed using inflation rates. Inflation rates measure the percentage change in average prices from one time period to the next.

Equation 1

$$r_i = (P_i/P_{i-1}) - 1$$

Where: r_i = inflation rate for time period i

P_i = average price level during time period i
= price level at midpoint of time period i

P_{i-1} = average price level during the previous time period
= price level at midpoint of time period i-1

If prices increase (or decrease) at a fairly constant rate during a time period, the average price level for the entire time period should be approximately equal to the actual price level halfway through the time period. Thus, the actual prices at the midpoint of a time period can be substituted for the average prices in Equation 1. The definition of an inflation rate can, therefore, also be expressed in terms of midpoints. An inflation rate measures the percentage change in average prices from one time period to the next. It also measures the percentage change in prices from the midpoint of the previous year to the midpoint of the next year. They are one and the same.

For example, the fiscal year for the U.S. Government begins 1 October. Therefore, an inflation rate of 3.5 percent for FY89 indicates that the average price level in FY89 is 3.5 percent higher than the average price level in FY88. It also indicates that prices are expected to increase by 3.5 percent from midpoint (1 April) FY88 to midpoint FY89.

The first step in calculating a raw inflation index is to designate a base year. The index for the base year is set equal to one. The index for year "t" is then calculated by escalating the base year index by the inflation rates expected to occur over the specified period of time.

The formula to calculate the raw inflation index is:

Equation 2

$$R_t = (1 + r_1)(1 + r_2) \dots (1 + r_t)$$

Where: R = Raw inflation index

t = Number of periods

r_i = Inflation rate for year i

Equation 2 is identical to the equation used to calculate the compound interest earned on an investment of one dollar where r_i would represent the interest rate in time period i.

The construction of raw inflation indices is fairly simple. To illustrate the computations assume the base year is FY87 and the raw inflation rates are as shown in Table I.

TABLE I. RAW INFLATION RATES

FY PERIOD	RAW INFLATION RATE(r)
88	3.5%
89	3.5%
90	3.3%
91	2.9%
92	2.4%
93	2.4%

Using the information in Table I and the formula represented by Equation 2, the indices for FY87 through FY90 are calculated as follows:

$$R_{87} = 1.000 \text{ because 1987 is the base year.}$$

$$R_{88} = (1.000) (1.000 + r_{88}) = (1.000) (1.035) = 1.035$$

$$R_{89} = (1.000) (1.000 + r_{88}) (1.000 + r_{89})$$

$$= (1.000) (1.035) (1.035) = 1.071$$

$$R_{90} = (1.000) (1.000 + r_{88}) (1.000 + r_{89}) (1.000 + r_{90})$$

$$= (1.000) (1.035) (1.035) (1.033) = 1.107$$

The computed raw inflation indices for FY87 through FY93 are displayed in Table II:

TABLE II. COMPUTED RAW INFLATION INDICES

FY PERIOD	RAW INDEX
87	1.000
88	1.035
89	1.071
90	1.107
91	1.139
92	1.166
93	1.194

Typically, inflation indices are expressed as percentages. However, for ease of computation, all indices presented in this article are expressed as proportions, not percentages. The indices can easily be converted to percentages simply by multiplying each index by 100.

Given the inflation rates, raw inflation indices can be computed using any given year as the base year. It is also possible, however, to achieve the same results without repeating the computations required by Equation 2. An existing index can easily be expressed in terms of a new base year through a procedure called rebasing. To obtain the new indices, divide the original index for each year by the original index for the new base year. For example, the indices presented in Table II can be rebased with FY90 as the new base year simply by dividing by 1.107, the original index for FY90. The computations are as shown in Table 3.

TABLE III. COMPUTATIONS

YEAR	RAW INFLATION INDEX Base Year = FY87
FY87	1.000
FY88	1.035
FY89	1.071
FY90	1.107
FY91	1.139
FY92	1.166
FY93	1.194

**RAW INFLATION INDEX
Base Year = FY90**

FY87	1.000/1.107 = .9033
FY88	1.035/1.107 = .9350
FY89	1.071/1.107 = .9675
FY90	1.107/1.107 = 1.0000
FY91	1.139/1.107 = 1.0289
FY92	1.166/1.107 = 1.0533
FY93	1.194/1.107 = 1.0786

By using the indices to account for the effect of price level changes, it is possible to determine what a particular program would cost if the required resources had been purchased in a different year. The relationship between prices and raw index numbers for any two time periods is:

Equation 3

$$P_m/P_n = I_m/I_n$$

For example, a comparison can be made between the estimated cost of an effort scheduled to be performed in FY88 and the actual cost of a similar effort performed in FY90. Suppose the FY88 effort cost \$90,000. Using Equation 3 and the indices in Table II, the cost of the FY88 effort in FY90 dollars is:

$$P_{88}/P_{90} = I_{88}/I_{90}$$

$$$90,000/P_{90} = 1.035/1.107$$

$$P_{90} = \$96,261$$

It is important to remember that the difference between the \$90,000 FY88 cost and the \$96,261 estimated cost for the FY90 effort reflects only the effect of changes in the price level. A comparison of the actual cost to the estimated cost must also take into account differences in schedule, quantity or other factors that may affect cost before a judgment can be made regarding whether or not the estimate is fair and reasonable.

Raw inflation indices are to be used only when all the resources are to be acquired within a single year. Often what happens is that a program requires the acquisition of resources over a time span of several years. When that is the case, weighted inflation indices must be used.

Construction of Weighted Inflation Indices

Weighted inflation indices are computed using raw inflation indices and overlay rates. Equation 4 represents the formula used to calculate a weighted inflation index when the outlay rates are defined as the proportion of the total actual or then year dollar cost spent acquiring resources in each year of a program.

Equation 4

$$W_t = 1/(O_1/R_1 + O_2/R_2 + \dots + O_k/R_k)$$

Where: W_t = Weighted Index for year t

O_i = Outlay Rate for year i

R_i = Raw Inflation Index for program year i

k = Length of the program

Note: If all costs were expended in a single year, the weighted inflation index would equal the raw inflation index.

Intuitively, Equation 4 does not seem to make any sense. Taking each outlay rate, dividing it by the appropriate raw inflation index, adding up these ratios, and taking the reciprocal of this sum seems like an unlikely process for developing a weighted index. However, it does work, and the easiest way to make sense out of this equation is to go step-by-step through the process of constructing a weighted index.

Table IV contains the raw inflation indices and outlay rates for a hypothetical program that will take 4 years to complete.

TABLE IV. DATA FOR HYPOTHETICAL PROGRAM

FY	RAW INDEX (R)	OUTLAY RATES (O)
87	1.000	.4335
88	1.035	.4466
89	1.071	.1008
90	1.107	.0191

The outlay rates represent the proportion of program dollars, including inflation, that will be spent in each year. Therefore, the first step in calculating the weighted index is to remove the inflation present in the outlay rates. To adjust the outlay rates to constant dollar terms, divide each outlay rate by the raw index for that year. These results are presented in Column 1 of Table V.

TABLE V. CALCULATING WEIGHTED INDEX

YEAR	(1) EXPENDITURE PROFILE INDEX	(2) COLUMN 1 DIVIDED BY .9764	(3) CORRECTED WEIGHTED INDEX
FY87	.4335	.4440	.4440
FY88	.4315	.4419	.4574
FY89	.0941	.0964	.1032
FY90	.0173	.0177	.0196
Total	.9764	1.0000	1.0242

Each entry in column 1 is:

Equation 5

$$O_i/R_i$$

Inflation has now been removed from the outlay rates. However, the adjusted outlay rates sum to .9764. Since the outlay rates represent proportions of total cost and, therefore, should sum to one, the next step is to normalize these rates so they will sum to the appropriate total. This is done by dividing each number in Column 1 by the sum of Column 1. The results are presented in Column 2 of Table V. Each entry in Column 2 is:

Equation 6

$$[O_i/R_i]/[O_1/R_1 + O_2/R_2 + O_3/R_3 + O_4/R_4]$$

All that remains to calculate the weighted inflation index is to multiply the inflation adjusted outlay rates in Column 2 of Table V by the raw inflation indices for each of the 4 years and sum the results. This procedure is equivalent to finding a weighted average raw inflation index where the weights are the inflation adjusted outlay rates. The results are presented in Column 3 of Table V. Each term in Column 3 is:

Equation 7

$$R_i * [O_i/R_i]/[O_1/R_1 + O_2/R_2 + O_3/R_3 + O_4/R_4]$$

Note that the numerator of Equation 7 can be simplified by cancelling the two R_i terms, leaving Equation 7A:

Equation 7A

$$O_i/[O_1/R_1 + O_2/R_2 + O_3/R_3 + O_4/R_4]$$

Since each term has the same denominator, the numerators are added together when the terms are summed. However, the sum of the outlay rates equal one. Therefore, the equation for the sum of the terms in Column 3 of Table V turns out to be Equation 4.

Equation 4

$$W_t = 1/(O_1/R_1 + O_2/R_2 + O_3/R_3 + O_4/R_4)$$

Why was it necessary to adjust the outlay rates? Each raw inflation index represents the price level for a given time period. Changes in the price level are measured by changes in the raw inflation indices. The original outlay rates represent the expenditure profile based on actual expenditures. These outlay rates, therefore, also capture the impact of price level changes. If the outlay rates were not adjusted to eliminate the effects of inflation on the expenditure profile, these effects would be double-counted. Inflation would impact on the calculation of the weighted index twice, once in the outlay rates and again in the raw inflation indices.

Of course, these results can be verified by using the information in Table IV and the weighted inflation index formula represented by Equation 4 to calculate the index for FY87. The weighted inflation index calculation for FY88 is also presented below:

$$WI_{87} = 1/[.4335/1.000 + .4466/1.035 + .1008/1.071 + .0191/1.107]$$

$$WI_{87} = 1/.9764 = 1.024$$

$$WI_{88} = 1/[.4335/1.035 + .4466/1.071 + .1008/1.107 + .0191/1.139]$$

$$WI_{88} = 1/.9437 = 1.060$$

The example above considers that it will take 4 years to spend all the dollars allocated to the project. The weighted index combines the outlay rates and the raw inflation indices to come up with a composite measure of inflation that reflects the way the resources will be acquired to accomplish the project.

If the outlay rates are defined as the percent of the constant dollar cost of the program to be spent in each year, then the outlay profile would look like Column 2 of Table V. In this case, Equation 4 would become:

Equation 8

$$W_t = O_1 \cdot R_1 + O_2 \cdot R_2 + \dots + O_k \cdot R_k$$

The difference between the two equations is that the outlay rates in Equation 8 have already been adjusted for inflation, while the outlay rates in Equation 4 are based on actual costs and, therefore, must be adjusted to remove inflation. Either equation is correct provided the outlay rates are properly defined.

The outlay rates developed by the Office of the Secretary of Defense (OSD) represent a typical distribution over time of the Total Obligation Authority (TOA) for select categories of appropriations. These funds represent the actual dollars required to support these endeavors, including inflation. Therefore, Equation 4 represents the approach that should be used to compute weighted inflation indices.

Weighted inflation indices are used to convert base-year dollars (BY\$) to then-year dollars (TY\$) and to convert then-year dollars to base-year dollars. Raw inflation indices are used to convert base-year dollars to constant-year dollars (CY\$) and constant-year dollars to base-year dollars. For example, an estimate generated in constant dollars is first converted to base-year dollars by dividing the constant dollars by the raw inflation index. The base-year dollars are then converted to then-year dollars by multiplying by the weighted inflation index. To illustrate, suppose you have developed an estimate of \$10 million in constant FY88 dollars. Dividing by the raw inflation index for FY88 (1.035) converts the estimate to a base-year dollar estimate of \$9.66 million. Multiplying this base-year estimate by the weighted inflation index for FY88 (1.060) provides a then-year dollar estimate of \$10.24 million for a 4-year program starting in FY88.

Equation 9

$$CY\$ / Raw\ Inflation\ Index = BY\$$$

$$\$10,000,000 / 1.035 = \$9,660,000$$

Equation 10

$$BY\$ * Weighted\ Index\ Number = TY\$$$

$$\$9,660,000 * 1.066 = \$10,240,000$$

The \$10.24 million represents the actual amount necessary to achieve this program. The goods and services required to support this program will be acquired in different time periods at different price levels. The additional \$240,000 represents the effect of inflation on the cost of these goods and services.

It is important to recognize that the effects of inflation occur at the time that resources are acquired. The timing of financial transactions, such as contractor payments, are not important insofar as inflation is concerned.

(See ADJUSTING, page 26)

SETTING PRIORITIES FOR

The Honorable Frank C. Carlucci

I think that the hearings on the amended FY 1989 budget so far, including Deputy Secretary (William H.) Taft's testimony before this committee in March, have gone very well. The budget authority and outlay levels for FY 1989 agreed to in the budget summit have been supported in the House and Senate budget resolution targets and the authorization committees' markups.

The Congress seems to share our concerns about the need to protect gains made to our defense capability and to retain an effective and ready fighting force. There seems to be a recognition of the difficulties we had in adjusting our budget, and I hope we can agree about the need for stability and predictability in defense funding.

However, I am concerned about congressional support in several areas that are critical to providing the military capabilities necessary to support our defense strategy:

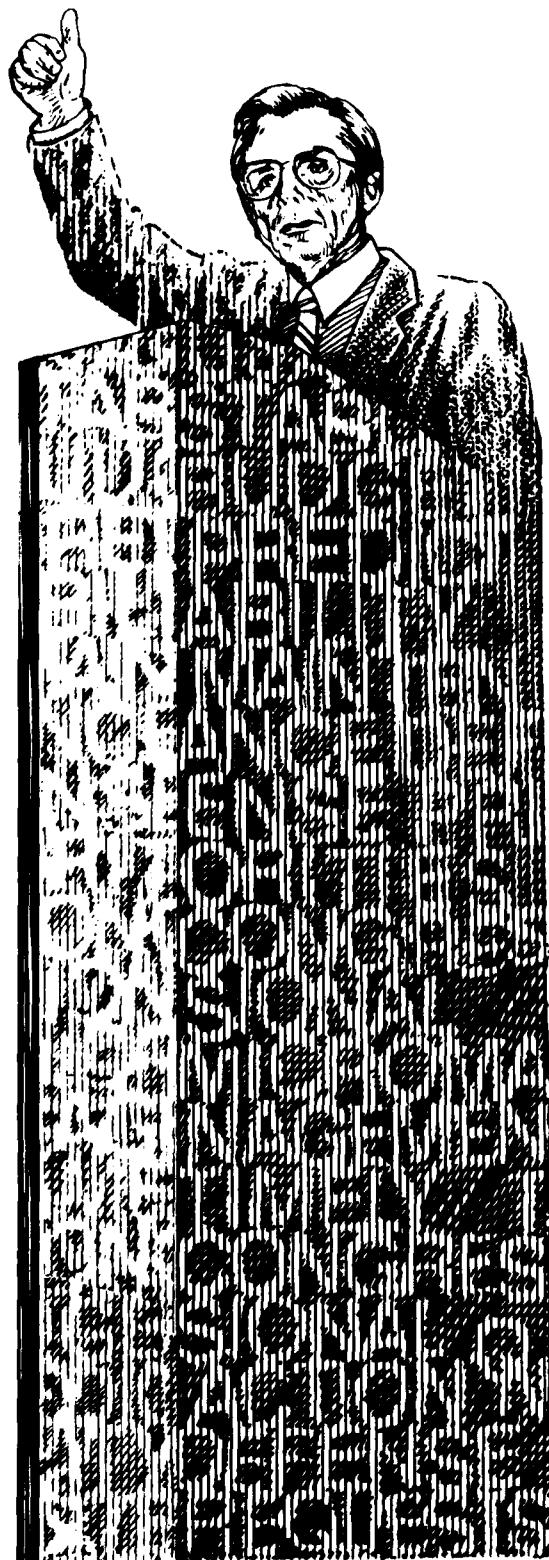
- Maintaining defense priorities
- Budget stability and predictability
- Congressional micromanagement
- Timely congressional action on defense requests.

I want to discuss my concerns about recent actions by the Congress and offer some solutions in each of these areas. I also want to discuss the importance we place on the INF treaty, the strengthening of our conventional forces in NATO and our efforts to ensure an equitable solution to the burdensharing issue.

Maintaining Defense Priorities

The defense budget this year is unique. We started the congressional review of the defense request with an agreed-to funding level that set defense budget authority and outlays for FY 1989 at \$299.5 billion and \$294 billion, respectively. We have supported the agreement because it set both a floor and ceiling on defense funding, and I feel it does support an affordable, sustainable plan to keep us safe. We will be able to keep top-notch people filling the ranks, ensure that our force, albeit smaller, remains at a heightened state of readiness and maintain efficient acquisition of weapons.

Our priorities in making the adjustments to meet the levels in the budget summit agreement were straightforward. We sought to protect people, readiness and efficient acquisition.



THE NATION'S DEFENSE

In order to pay for these priorities, we had to make a number of painful choices to achieve the best defense capability at the constrained budget level.

Rather than risk reducing the quality of the people in the force by reducing the pay raise, we proposed reducing personnel levels.

Rather than let the readiness of the force diminish by cutting training and support, we proposed reducing force structure.

Rather than decrease quantities of a large number of production programs and incur higher unit costs, we proposed terminating uneconomical or marginal programs, re-evaluating new programs, deferring some programs and delaying the start of others.

The priorities we set have not changed. However, congressional action to date on our request raises many issues of national priorities within the defense budget. For example, the House Armed Services Committee (HASC) shifted about \$6 billion to programs they perceived to have a higher priority, and House floor action made further realignments. Although many of the additions recommended by the House would be useful if considered separately, I do not believe they are consistent with the overall balance of the president's amended FY 1989 request. Nor are they affordable in view of current fiscal constraints.

The HASC reduced the military pay raise to 4 percent and reapplied these "savings" to other areas. This ad-

ministration attempted to protect an adequate pay compensation rate within the budget summit agreement levels, particularly for the military members who serve this country and provide our defense. The 4.3 percent pay raise for military personnel is critical to preserving some of the gains made since 1981 in recruiting and retention. Since 1982, private-sector pay has increased 11 percent more than military pay as a result of caps on the size of military pay raises. It is essential for recruiting and retention that there not be a further decline in the relative value of military pay.

The House reduced \$700 million from the Peacekeeper/Rail Garrison program and added \$400 million to the Small ICBM program, Midgetman. Our clear preference is for Peacekeeper/Rail Garrison. The termination of the Small ICBM program would save approximately \$39 billion in acquisition costs. The cost of 100 MX missiles in Rail Garrison would be approximately \$17 billion and would provide us with 1,000 warheads compared to 500 warheads on Midgetman. It is my view that, given the fiscal constraints we confront and the likelihood of continuing constraints in the outyears, it is going to be extraordinarily difficult, if not impossible, for this country to afford two land-based, mobile missile systems. However, in the interests of maintaining what has come to be called the strategic consensus on the Hill, I agreed to put \$200 million in this budget request, which, when put together with the \$700

million voted last year, should be enough to keep Midgetman going through the fiscal year. This would provide the next administration with the option to restart the program, should it choose to do so.

The House reduced some \$1.4 billion from the Strategic Defense Initiative program. The \$4.5 billion for the SDI program we requested in the amended budget continues the technology demonstration and validation program necessary for a feasibility decision on strategic defenses. SDI has been restructured as a result of congressional cuts, but continues to make satisfactory progress toward an effective defense. We are confident that our goals for SDI can be met, and we request that the necessary funds be approved to allow us to continue our efforts to eliminate the threat posed by strategic nuclear missiles.

For the most part, the Senate Armed Services Committee sustained the defense priorities we adopted in the amended budget and further recognizes the need to protect these programs in the future.

Budget Stability

One of our greatest problems continues to be the instability of defense funding. The budget summit agreement affords an excellent opportunity to create a consensus between the executive and legislative branches on realistic and stable funding for defense programs. We strongly believe that this is overdue. The adjustments we

have made to support the bipartisan summit agreement represent a good faith effort on our part to help achieve this consensus.

Nevertheless, the .7 percent decline in real growth in the amended FY 1989 budget marks the fourth consecutive year of lower defense funding. If the trend continues, we could very well return to a sustained period of under-funding for defense. The erratic increases and decreases in defense funding over the past 20 years led to substantial inefficiencies in program execution. There is no question that we could generate savings, especially in procurement, if we could return stability, predictability and steady growth to defense funding. Without stable funding, we cannot protect the gains we have made after seven years and almost \$2 trillion or guarantee that our restructured forces can sustain our security responsibilities.

However, long-term stability cannot be achieved with just one budget. The approximate 2 percent annual real growth proposed in the DoD topline for FY 1990 to FY 1993 is the minimum necessary for us to support adequately our forces and continue our modernization program to meet future threats to our security. In fact, there is some question whether further trimming of force structure may be needed. The 2 percent real growth does not entail an increase to previous... estimates for the same period. In fact, it represents a decrease from earlier topline estimates, which called for real increases from 3 to 5 percent from a higher starting point.

This topline was provided to the services for the preparation of their program objectives for the next five years. The review of these programs is currently under way. I should point out that the guidance provided to the services in preparing their program objectives reflects the same priorities that we used in preparing our amended FY 1989 request: retain quality people, maintain readiness and program for efficient acquisition. While it has not been an easy task for them to rescale their programs within this fiscal guidance, I believe that we will be able to retain an efficient and effective force

if the Congress will support our modest 2 percent real growth topline.

Unfortunately, both the House and Senate budget resolutions propose reductions ranging from \$3 or \$4 billion in FY 1990 and \$8 or \$9 billion in FY 1991. While I am heartened by congressional action to sustain the budget summit agreement for FY 1989, I am concerned about the lack of congressional support for our current topline.

There is no question that we could generate savings, especially in procurement, if we could return stability, predictability and steady growth to defense funding.

Another important component of budget stability is the enactment of authorizations and appropriations for two fiscal years at a time. The overriding benefits to the department from biennial budgeting would be the program and resource stability resulting from economical program execution available to defense managers. Materials and components could be purchased more efficiently using economic order quantities earlier in the contract period. This is particularly true of long-lead components, such as those required for shipbuilding or major weapon systems.

The ability to employ multiyear contracts has proven cost effective, as the reduced risks to the contractors are translated into lower costs to the government. Biennial budgeting would facilitate the aggressive use of multiyear procurement and encourage more competition. The assurance of two years of production should attract additional competitors for defense pro-

grams, especially those on the margin, who may have deemed it not cost effective to tool and train for only one year's effort. It would also help us to strengthen the defense industrial base.

The department has fully implemented a two-year cycle and will submit a biennial budget next year for FY 1990/FY 1991. What is required now to achieve the true benefits and efficiencies of biennial budgeting is the full commitment by the Congress to enact authorizing and appropriating legislation for that two-year request.

Stability is also the key to effective management, quality performance and affordability of defense acquisition. Stable funding by the Congress is a prerequisite to meeting program cost and schedule goals; stable, well-considered requirements, understood and supported by government and contractor, will eliminate costly changes later; and a stable legislative and regulatory environment allows creative and experienced people to utilize fully the tools provided in their search for improved quality and reduced cost.

We are introducing a total quality management strategy in the department and to its contractors. Quality will be the responsibility of the entire acquisition team from design through production to deployment. Studies have shown that 95 percent of the effort involved in production is related to efforts other than actual physical production. We will focus on the inefficient and costly practices that occur within this 95 percent.

The success of our strategy to improve quality in defense products and (to ensure) a more efficient acquisition process depends on increased cooperation between the executive and legislative branches and between government and industry. We will seek positive and cooperative ways for the department and industry to work together to reduce costs and promote quality.

Congressional Micromanagement

In recent years, issues other than national security have dominated defense budget deliberations. Defense legisla-

tion has become burdened with restrictions on subjects ranging from contracting procedures to arms control, as the Congress has sought to manage the funding and execution of our programs at lower and lower levels. This situation has created budgetary chaos and disorder that is not conducive to making effective defense budget and program decisions and denies us the necessary management flexibility to get more defense out of available resources.

I have been encouraged by the budget summit agreement to believe that progress could be made to eliminate the congressional temptation to micromanage defense programs. However, the HASC report proposed 239 amendments. The addition of this large number of amendments endangers our chance to make progress toward stability and reliability in the budget process. I do not deny the congressional prerogatives to make such amendments. However, the large number of irrelevant issues addressed in these amendments inhibits prompt and decisive congressional review of our defense requests. I would hope that this committee would address this issue objectively and avoid the delays and vacillation caused by this micro-management.

One specific area of concern has been our attempts to close or realign military installations to better meet our requirements. In recent years, these efforts have been adversely impacted by legal restrictions and funding problems. I know this is an important issue to the Congress, and we are not insensitive to the effects base closures have on local communities.

In fact, there is much documentation that shows communities have actually benefited from base closures. However, the primary consideration for decisions regarding the use of our facilities must be based on security needs and how best to provide for those needs in the face of declining resources. Last week, I announced the establishment of a Commission on Base Realignment and Closure. Former Senator Abe Ribicoff and former Congressman Jack Edwards have agreed to co-chair this commission.

The primary objectives of the commission are to determine the best process and criteria for identifying bases to be closed or realigned and how to improve and best use the federal government incentive programs to overcome any negative impact of base closure. The commission will report its findings and recommendations for base closure and realignment to me by the end of this year. The legislation on base closure and realignment included in the SASC report and being considered by the House is crucial to the success of this endeavor.

Timely Congressional Action

The lack of prompt and decisive congressional review of administration requests further hinders the effective management of defense resources. The process has become too time-consuming. Congressional target dates

I do not deny the congressional prerogatives to make (budget) amendments.

However, the large number of irrelevant issues addressed in these amendments inhibits prompt and decisive congressional review of our defense requests.

are often missed, authorization bills are often enacted so late that they are concurrent with the appropriation bills rather than preceding them, and appropriation bills are rarely enacted before the beginning of the fiscal year. Defense appropriations for FY 1988 were not enacted until late December, and, unfortunately, this situation is continuing in the current congressional review. Although the House and

Senate budget committees have approved the FY 1989 national defense level that was set in the budget summit, the Congress missed its suspense date for a budget resolution by April

INF and START

The achievement of effectively verifiable and stabilizing arms reduction agreements is our primary arms control goal. The INF agreement is a very important component of this priority, and we urge the Congress to demonstrate its support with ratification of the treaty. Implementation of the INF treaty requires costs totaling \$171 million in FY 1988.

These requirements include personnel and contract support costs for the inspection and escort teams at sites in the United States, basing countries and the Soviet Union. They also include costs associated with destruction and elimination of missiles, launchers and facilities. I strongly urge the Congress to approve the reprogramming actions we submitted on April 25 to fund these important requirements. The outyear requirements for INF treaty implementation are being addressed in the current program review.

We are also seeking an agreement with the Soviets leading to deep, equitable and effectively verifiable reductions in the number of strategic nuclear arms held by both sides. We have not identified any specific programs in the FY 1989 amended budget associated with START, but outyear requirements are being considered in the FY 1990/FY 1991 program review.

Support for NATO

The amended FY 1989 budget includes programs which reflect a commitment to NATO, especially to the implementation of those improvements relating to the 1983 Montebello Decision and the 1984 Conventional Defense Improvements program. Although most of these are not new initiatives, the signing of the INF treaty highlighted the importance of continuing these ongoing modernization efforts.

To further these modernization efforts, we requested the Congress to lift current limitations on nuclear artillery rounds and remove restrictions on further development of advanced tactical missiles as a follow-on to LANCE. We also requested an increased level of funding for NATO cooperative programs, as we continue to expand our cooperative development efforts to redress significant deficiencies in our collective conventional defense posture.

We must continue efforts to investigate new technologies which will strengthen our capability to conduct a flexible conventional response. Toward this end, we have initiated the Competitive Strategies Initiative, a method of strategic thinking that evaluates our national defense strategy in terms of our long-range relations with the Soviet Union.

The competitive strategies approach will allow us to respond to changes in the strategic environment in a way that makes the most effective use of our resources. Our initial task force focused on a mid- to high-intensity conflict in Europe, and the task force recommendations are being staffed now, with a view toward the best way to implement them.

Allied Burdensharing

In view of concerns about the federal deficit, many in the Congress have expressed their desire that foreign countries in which we have a large concentration of American military personnel should increase their share of the defense burden.

Our forces are deployed throughout the world in support of our policies to meet the global threat to our security. Maintaining forward-deployed forces

in areas where we believe an attack would be most likely to occur is of great importance to us. Soviet-bloc forces could launch a major attack with limited warning in many areas, most notably Europe and Northeast Asia. It is no surprise, therefore, that most of our overseas-deployed forces are located in Europe, Korea, the Philippines and Japan, and naval forces are in waters adjoining those areas as well as in Southwest Asia.

We maintain these forces at a high state of readiness to enhance their deterrent value and to improve our chances of defeating an attack should deterrence fail. Withdrawing U.S. forces from Europe or the Pacific rim for reasons unrelated to national security would increase the risk to U.S. security interests in those regions, while at the same time reducing our ability to deal with them.

Nevertheless, we are not insensitive to the concern about the increased costs of deploying our forces overseas and the burdensharing issue. We take very seriously the importance that the sharing of roles, risks and financial burdens has on improving allied defense capabilities. Therefore, we have formed a special DoD task force to address equitable burdensharing with our NATO allies and Japan.

The goal of the task force is to examine the roles, risks and responsibilities relating to the common defense and make recommendations on promoting a more equitable distribution among our allies. Deputy Secretary Taft is conducting initial visits to NATO and allied capitals to sensitize our allies to the significance of the problem, exchange views and create a positive review of the burdensharing issue.

Whenever in this publication "man," "men," or their related pronouns appear, either as words or parts of words (other than with obvious reference to named male individuals), they have been used for literary purposes and are meant in their generic sense.

Next, action will be taken to propose specific measures to promote equity. Specific measures and initiatives necessary to ensure efforts are maintained will be discussed in a follow-up trip. After that, we will prepare and forward a report to the Congress on the results of these efforts and establish an action plan for the future.

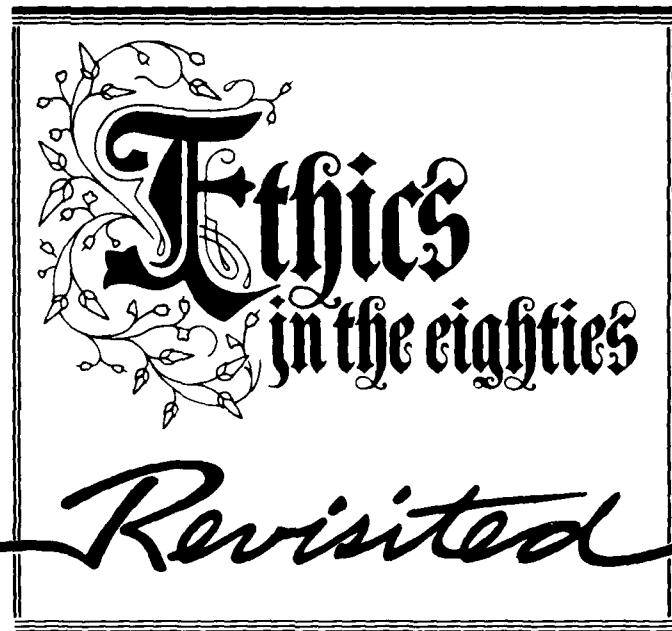
Our aim should be to work within our alliances to encourage our partners to do more, rather than simply making an indictment against allies to justify our doing less. I welcome the expressions of support for our initiatives from members of this committee. If our efforts are going to be successful, we will need your continued support.

Conclusion

The priorities we have established to build our forces within the reduced levels of funding provided by the budget summit agreement are integral to our ability to maintain an overall balance in our defense programs. I urge the Congress to sustain these priorities. I also urge support for our revised defense topline.

The early years of this administration experienced much needed budget increases to restore the neglected and hollow defense force structure that existed in the 1970s. But this FY 1989 budget marks the fourth consecutive year of real decline in defense purchasing power. The Congress can stem this erosion by joining us in our efforts to create stability and predictability in defense funding by supporting biennial budgeting and approving the moderate, consistent growth in future defense budgets we are proposing.

This is a statement of Secretary of Defense Frank C. Carlucci before the Senate Appropriations Defense Subcommittee, May 10, 1988.



Ethics in the eighties

Revisited

David D. Acker

A series, "Ethics in the Eighties," by Professor Acker appeared in *Program Manager* in September/October and November/December 1986, and January/February 1987. Positive and supportive comments received from readers in the United States, Canada, Mexico, Australia, Venezuela and Czechoslovakia, prompted this update. Before this article went to press, the Department of Justice disclosed alleged misconduct by some Department of Defense employees, consultants and contractor personnel. If true, this is unfortunate. In this article, Mr. Acker indicates the Department of Defense and many companies in the defense industry have established codes of ethics to prevent wrongdoing. Government and industry employees are cautioned about activities not in keeping with U.S. law and government regulations. The Department of Defense is involved annually in more than 15 million contractual actions totaling approximately \$165 billion and involving one million Department of Defense personnel and contractor employees.

This paper addresses ethics, ethical principles, and standards of conduct, enhances topics covered in previous articles and concludes with a discussion of distinguishing characteristics of vanguard managers.

Development of character begins in childhood, but doesn't end there. During our lifetimes, we read, think, reflect, mature, and develop attitudes, habits, integrity and dignity that line our paths to the future. We use growing personal knowledge, skill and experience, education, religious resources, and heroes to sharpen ethical tools and add new ones to improve human environment.

Ethics is the science of right and wrong. We judge people by their actions and decisions—by their ethics. The term "ethics" is sometimes used interchangeably with "morals"

or "morality." The words are not synonymous but are often treated as such. These words have distinctive meanings. Ethics is concerned with the philosophical premises upon which imperatives are based. Morality, a descriptive science, is concerned with the indicative—with what people do as opposed to what people ought to do. Of course, there must be some relationship between ethical theories and moral behavior. Our beliefs generally dictate our behavior. Our value system is manifested by our actions. We normally seek the right. We seek an objective basis for our ethical standards—norms and principles transcending prejudice or societal conventions.

We have an ethical attitude not only about our own actions, but about those we carry out as members of society.

In a democracy, such as we enjoy, good government is a result of a good system of group ethics practiced by a majority of our citizens. As citizens, if we feel the actions of our government are wrong, we can campaign actively for a change in government. The opposite holds, if we feel the government is functioning well.

Likewise, if one is an employee of the government, it is of paramount importance that he/she avoid any action that can result in or create the appearance of:

—Using public office for private gain;

—Giving preferential treatment to any person or entity;

—Impeding efficient or economic operations;

—Losing complete independence or impartiality;

—Making a decision outside official channels;

—Affecting adversely the confidence of the public in one's integrity.¹

I would be quick to admit that it is not easy to recognize and choose the correct course of action in every situation, or make the right ethical decision on a tough problem. Ethics deals with moral duty and obligation, and is a complex subject. Ethics is one of the intellectual dimensions of life. In our day-to-day actions, a pattern of good ethical conduct emerges when we reflect on our highest principles as well as on the possible consequences of our action before we act.

Standards Associated with Defense Acquisition

Now, let's direct our attention to defense acquisition. For some time, one of the major topics of concern by people in the top levels in the U.S. Government's executive branch, the military hierarchy, the Congress, and the press has been the ethics of defense acquisition personnel. Because of the importance of Department of Defense (DOD) acquisition to the defense of our country, many government contract specialists believe that a higher level of ethics may be expected of them than may be expected of their counterparts in industry. Therefore, many defense contractors have been pro-

It is gratifying that Americans are demanding high ethical standards in personal relationships and from public figures.

mulgating and enforcing codes of ethics that address the unique disciplines and procedures associated with defense acquisition. Also, they have been developing and implementing internal controls to monitor codes of ethics and sensitive aspects of contract compliance.

In 1986, the Packard Commission determined that DOD was administering and enforcing ethics regulations established for military and civilian personnel. The DOD had developed specific guidance relative to ethical conduct, and special educational programs to deal with matters of concern to the acquisition management community. The DOD standards-of-conduct were reviewed and updated periodically.

At the completion of its study, the Packard Commission made recommendations to defense contractors and, for the most part, the recommendations have been carried out. The principal recommendations were:

—Review your internal policies and procedures to determine whether they ensure performance in compliance with special requirements of government contracting. If they do not, revise them to assure they address the special requirements of government contracting.

—Ensure your standards of ethical conduct foster compliance by employees with the ethical requirements of the federal government. This will ensure the utmost propriety of your employees in their relations with government personnel.

—Develop an instructional program to ensure that internal company policies and procedures are articulated clearly and understood by all company personnel.

—Establish an independent audit committee responsible for overseeing the company system of monitoring and enforcing compliance with company standards of conduct. In cases where it is not feasible to establish such a committee, develop a suitable alternative mechanism.

The DOD Directive 5500.7, "Standards of Conduct," addressing, among other matters, specific conflicts of interest and concerns that may arise in official dealings between the government and the contractor, employment negotiations, and post-government relationships with defense contractors, was revised and reissued in May 1987 to comply with recommendations of the Packard Commission. Before the revision, the acquisition work force generally agreed there was a need to simplify the rules, regulations, and policies under which contracting officers work. The work force believed the acts, laws, and regulations affecting them prevented their performing jobs in a timely manner, caused them needless confusion, and led to inefficiency. A majority of the work force felt the rules and regulations tended to prevent the exercise of sound business judgment.

Contract specialists believe the DOD should continue promoting ethical standards among employees in the defense acquisition business. The DOD managers should communicate their expectations; supervisors should have opportunities to observe on a regular basis an adherence to standards which are usually identified in individual performance evaluations. By providing positive performance evaluation feedback, the work force will be encouraged to recognize and eliminate fraud, waste, abuse, and actual or perceived conflicts of interest.

Although corporate America has codes of ethics, unexpected problems occur. Last year, Wall Street reeled from the Boesky scandal, and there were revelations about falsified research by scientists at two American

medical schools. A subcommittee of the U.S. House of Representatives estimated one out of three working Americans was hired with falsified education and/or career credentials.

Problems like those involving government and contractor employees that were recently in the national spotlight should not be considered the norm. Unfortunately, the actions of a few who ignore the standards can, in some cases, cause irreparable damage to those practicing good ethics.

A *U.S. News and World Report/Cable News Network* poll last year indicated half of those contacted think Americans are less honest than 10 years ago; seven out of ten were dissatisfied with present-day standards of honesty. Nevertheless, people highly prize honesty, saying it is the most important characteristic in a friend, ranking ahead of intelligence and common interests.

Ethical Standards Receive Attention

It is gratifying to report that Americans are demanding high ethical standards in personal relationships and from public figures. The expanding "values education" programs in U.S. public schools suggest we want our children to understand and display high ethical standards. We want "to trust our institutions and the leaders of our institutions," says Gary Edwards, The Ethics Resource Center. "In business," adds Edwards, "where that doesn't happen, you lose economic freedom and get more regulation. In government, when trust and confidence break down, you get apathy, cynicism and, ultimately, anarchy."²

Many American companies hire ethics specialists, issue ethics policies, and start programs to ensure their employees and managers are informed and know how to perform in an ethical manner. Also, companies are devoting more time and resources to verifying the records of prospective employees.

One defense contractor issued a statement: "We seek to conduct all of our affairs according to the highest legal and ethical standards. This is the



Diogenes, looking for an honest man.

keystone of our philosophy. Unlike other goals, where compromises may be necessary, we intend that it override all else that we do in pursuing our other objectives and goals."³

Another defense contractor said "It is certainly essential that every individual employee have a personal commitment to meeting the highest ethical standards, as well as meeting the more obvious requirements for quality, schedule, and budget....The company's reputation reflects the performance of the individual employees."⁴

Another defense contractor accepted responsibility to create an environment in which compliance with federal procurement laws and the free, open, and timely reporting of violations are recognized as the responsibility of every employee.⁵ This contractor said "each employee must apply his/her own sense of personal ethics, which should extend beyond compliance with applicable laws in business situations, to govern behavior where no existing regulation provides a guideline." In determining compliance, company management asks each employee to ask questions like these:

- Is my action legal?
- Is my action ethical?
- Does my action comply with corporate policy?
- Does my action appear inappropriate?
- Would I be embarrassed or compromised if my action became known throughout the company or publicly?

Unfortunately, ethically based decisions of employees and managers anywhere are usually predicated on limited knowledge of the law and generally accepted rules of ethical conduct. Managers making value-laden decisions daily may not seriously consider underlying bases. Few managers have been taught during their formal education, or on-the-job, basic principles of ethical conduct.

A recent survey of business leaders, business-school deans, and members of the United States Congress provided these results. Countries with the highest business ethics are the United States of America, Great Britain, Canada, Switzerland, the Federal Republic of Germany, and Japan.⁶ Erosion of business ethics results from decay in family life and/or cultural and social institutions, increased concentration on short-term earnings, business conduct in ethically different cultures, and attempts to cope successfully with volatile economic conditions. Clergy, accountants, teachers, engineers, and physicians are the most ethical professionals.⁷

These findings are interesting but what can, or should, we do with this knowledge? What role does, or should, ethics play in our work environment? Has the term "business ethics" become oxymoron? If Diogenes, the Greek Cynic, strolled down a U.S. country road or city street today, would he find one honest man?⁸ Hopefully, he would.

In many quarters we hear that "contracting with the government is no longer fun." Many entrepreneurs formed companies years ago to sell goods and services to the federal government and viewed the work as rewarding from financial and substantive points of view. Now, many complain about responding to government audits and reviews. This diverts attention from the work they enjoy. The audits and reviews are perceived as hostile in nature, and perception has become reality. Auditors are ferreting out fraud, waste, abuse and, in some cases, mismanagement in government contracting. A recent opinion poll found 80 percent of the general public believe defense contractors should set higher ethical standards.

U.S. Office of Government Ethics

In 1978, the Office of Personnel Management (OPM) established the U.S. Office of Government Ethics (OGE), charged with ensuring a high standard of conduct among officials in the executive branch. In the legislative branch, the U.S. House of Representatives Ethics Committee and the U.S. Senate Counsel perform similar functions. Judges and other judicial officers are bound by the Ethics in Government Act (issued in 1978; amended in 1983). The Judicial Conference of the United States has a Judicial Ethics Committee.

According to Donald E. Campbell, acting director of OGE when this paper was drafted, the ethics program of the federal government is decentralized. Responsibility for ethics resides in each executive-branch agency. This is the heart of the ethics program in the federal government. The OGE is authorized to take corrective actions to prevent conflicts of interest or the occurrence of unethical situations; however, its function is not to dismiss employees or initiate criminal proceedings. When it comes to a punitive action, the role of the OGE is advisory and, after a matter is referred to the Department of Justice, does not act until the matter has been resolved. The OGE director, with a difficult balancing act, is a political appointee making judgments on other political appointees, some of whom may be closer to the president of the United States.

A Closer Examination

Ethics isn't a fad that is "here today and gone tomorrow." It is a value shared by society as a whole. Our society is not perfect, but we place high value on good ethical conduct and consider that the norm in American society.

In his book, *Inside U.S.A.*, John Gunther said, "Ours is the only country founded on a good idea."⁹ The good idea is a combination of a per-

son's inalienable rights and the Calvinist belief that there is an ultimate moral right.¹⁰ Articles of faith, governing the lives of Americans today, are embodied in the Declaration of Independence and United States Constitution.

Many people have sought a supreme principle of conduct so broad and fundamental that it can be used to define all ideals. They considered probable effects of their acts on the well-being of people with whom they interfaced and acted in a manner which serves the highest human welfare.

Personal knowledge of ethics provides the basis for two types of moral decisions. One requires we discern



Henry Cabot Lodge, Jr.
(1902-1985)

what is good, and the second requires moral courage to do what is good. By studying ethics, we can learn to make the right decisions. A clear understanding of this subject will enlighten our minds and strengthen our wills.

The University of Michigan Center for the Study of Higher and Postsecondary Education studied whether professional programs are providing a sufficiently broad education. Its survey of more than 2,000 faculty members from 10 professional programs, including engineering, resulted in a list of "liberal outcomes." Most faculty

members agreed that graduates of bachelor's and master's professional programs should:

—Understand the social, environmental, economic, and cultural setting in which professional practice occurs.

—Know and apply *ethical principles* and professional standards of conduct.

—Use written and oral communication skills effectively.¹¹

It is not easy to select and apply appropriate ethical principles to the solution of personal (business or social) problems, but we should try. On an international basis, it is important that our representatives apply the same principles to solve problems. When a problem is worldwide, it must be assessed and solved by people with the necessary expertise and vision. Henry Cabot Lodge, Jr., when U.S. Ambassador to the United Nations, said: "The future of the world depends on the extent to which we can base international relations on that sense of justice and fair play which is in every human heart."¹² This is one enlightened way to face and solve the problems of war and peace. It applies equally well to solving problems of race relations, labor and management.

Because there isn't a universal code of ethics, people and organizations have established codes. According to Daniel Callahan, director and co-founder of The Hastings Center, "When most people talk about morals, they are concerned with laws and regulations and codes." If a rule or code does not exist to regulate a particular situation, Callahan said, "We assume it is pretty much everyone for himself."¹³ In other words, without focused guidance people will scramble to shore up corners of their ethical roofs or will develop their own rules and codes. In the United States, where there are myriad cultures and religions, we cannot look to a particular church, educational institution, or private association as the center of ethical teaching. Furthermore, we find little effort on the part of those who teach ethics to develop a science.

Code of Ethics

Professions like engineering, law, medicine, and management have adopted codes of ethics.

Fundamental principles in the *Code of Ethics of Engineers* issued by the Engineers' Council for Professional Development (ECPD) state "Engineers uphold and advance the integrity, honor, and dignity of the engineering profession by:

- Using their knowledge and skill for the enhancement of human welfare
- Being honest and impartial and serving with fidelity the public, their employers, and their clients
- Striving to increase the competence and prestige of the engineering profession."¹⁴

The *Cannons of Professional Ethics* of the American Bar Association frowns when a lawyer attempts to start a lawsuit to get clients; the medical code of ethics condemns practices like fee-splitting. These codes are of great value in providing a framework for honorable behavior, but their effectiveness depends upon the integrity and sincerity of those involved.

The National Management Association's *Code of Ethics*, developed many years ago, encourages members to apply ethical standards to everyday supervisor-worker relationships. The code states:

I resolve to recognize that every man above, beside, or below has an inherent desire to do good work and to be a useful and respected citizen. Until I have considered every possible motive, I will not assume that any man wants to do anything but his best.

I resolve to keep an open mind on all subjects, and strive to maintain a broad and balanced outlook. I will always be willing to recognize merits in another's ideas.

I resolve to deal fairly with all my associates in the company (or business). I will assume responsibility for my own mistakes and refrain from blaming others.


Professional codes of ethics are of great value in providing a framework for honorable behavior, but their effectiveness depends upon the integrity and sincerity of those involved.

I resolve to strive to understand the principles of business which make for the success or failure of industry. I will pass on to my people all the fundamentals of business principles so they can see, for themselves, their own relation to the general scheme.

I resolve to keep informed as to the latest development in equipment and processes. I will recommend or put into effect such methods as will produce improved quality and lower costs for products, and improve working conditions.

I resolve to realize that one phase of my profession is to help working people obtain maximum satisfaction from life.

I resolve to earn and carefully guard a reputation for good moral character, good citizenship and common honesty, and I will support and promote all the uplifting influences of my community.¹⁵

This code stresses fairness, honesty, understanding, unselfishness, service, and morality.

Setting high standards is necessary, keeping in mind that managers are human and can make mistakes. Honest mistakes can be a foundation for building better relations with

associates and subordinates. It is not a fair or ethical practice to "pass the buck" when a problem arises. We should not go over a manager's head for a decision, and should not publicly ridicule or criticize people in authority. We should avoid over-familiarity, personal remarks concerning other managers, "showing up" another manager, quarreling or abusive language, withholding needed information, becoming indebted or obligated to employees, empty promises, favoritism and bragging. We should not betray confidences, divulge confidential information, or engage in gossip.

To the average employee, the character of the organization is represented by the immediate supervisor. The average employee usually has little, if any, contact with the top-level manager who established policies and procedures. The manager directly supervising the employee usually shapes the character of the immediate organization. When given managerial responsibility, don't make impulsive decisions, regardless of provocation. Consider cause and effect, action and consequences. Then, make the decision.

Ethically Guided Actions

Let's consider whistle-blowing, disclosing suspected problems and needed improvements. The Department of Defense and other government agencies have methods to report mismanagement, fraud, and waste, and employees should report suspected problems. Inspectors General review substantive issues reported to them and ensure administrative and criminal remedies are pursued.

One case of ethics in the news involved Dr. Roger M. Boisjoly, former Morton Thiokol engineer associated with the ill-fated Challenger launch.¹⁶

He advised managers at Morton Thiokol, the Kennedy Space Center, and the Marshall Space Flight Center on Jan. 27, 1986, not to launch the Challenger spacecraft the following day. In his testimony before the presidential commission investigating the accident, Dr. Boisjoly called the launch "an irresponsible decision."

Dr. Boisjoly noted that more than 20 years ago he received superb advice from a quality assurance manager that he has applied throughout his career. "This manager," said Dr. Boisjoly, "told me to ask myself the following question when faced with a tough decision as to whether a product is acceptable: Would you allow your wife or children to use this product without any reservation? If I could not answer that question with an unqualified 'Yes,' he said, I should not sign off on the product for others to use. That is what an ethical analysis of acceptable risk should be."

Academics, Dr. Boisjoly told the commission, have studied many cases of ethical conduct and whistleblowing, producing two conclusions. First, whistle-blowers usually attempt to achieve problem resolution through their organizational chain of command. Second, whistle-blowers are punished by the organization when the whistleblowing is heard outside the organization. Engineers speaking against the Challenger launch worked through their normal chain of command and with Dr. Boisjoly were punished after giving testimony to others.

In his presentation before the American Society of Mechanical Engineers last December, Dr. Boisjoly discussed professional responsibility, accountability, and ethics from a perspective enriched by 2 years of experience after the accident. He cited as "timeless" the advice of Adolph J. Ackerman, who penned the following for a professional paper in 1967: "Engineers have a responsibility that goes far beyond the building of machines and systems. We cannot leave it to the technical illiterates, or even to a literate and overloaded technical administrator to decide what is safe and for the public good. We must tell what we know, first through normal administrative channels, but when these fail, through whatever avenues we can find."

Mr. Ackerman wrote more than 20 years ago that "many claim that it is disloyal to protest. Sometimes the penalty—disapproval, loss of status, even vilification—can be severe. To-

day we need more critical pronouncements and published declarations by engineers in high professional responsibilities. In some instances, such criticism must be severe if we are properly to serve mankind and preserve our freedom. Hence, it is of the utmost importance that we maintain our freedom of communication in the engineering profession and to the public. The decades ahead are bound to be critical and difficult periods, and there will be occasions for sharp dissent and strong words if we are to meet our responsibilities."¹⁷

Recalling the Challenger disaster, Dr. Boisjoly said, "...if anything good can result from this tragedy, I hope the academic institutions and professional societies will recognize the importance of teaching ethical behavior in decision-making situations and use actual case histories like this one to demonstrate what can go wrong...be prepared for what to expect when confronted with a similar situation requiring an ethical decision."

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Distinguishing Characteristics of Vanguard Managers

A popular sport among business professors, management theorists, and consultants is developing a list of distinguishing characteristics of "best" companies; characteristics distinguishing them from the pack. James O'Toole believes it is a philosophy of management that embodies abstract concepts like "balance, integration, harmony, coherence, and justice."¹⁸

He offers characteristics which vanguard management hold in common. They:

- Try to satisfy all their stakeholders
- Are dedicated to high purpose
- Are committed to learning
- Try to be the best at everything they do.

These companies have managers with moral courage—"the courage to change direction when things are going well; the courage to hire brilliant subordinates and allow them to shine; the courage to be an innovative subordinate; the courage to stick to their values in tough times; and the courage to resist pressure for short-term action."¹⁹

Moral qualities of a good manager include integrity, loyalty, cheerfulness, patience, courtesy and humility. Integrity is a key to business success. A study of senior-level executives last year revealed integrity is the quality most often listed as necessary for business success. Seventy-one percent of the corporate leaders listed it at the top of traits most responsible for enhancing their chances of success. The study surveyed more than 1,300 senior-level executives and collected data on careers and personal lives of American corporate leaders.²⁰

Stephen Bailey believes the three essential moral qualities of good managers, especially those in public service, are optimism, courage and fairness tempered by charity.²¹ Let's examine these qualities.

Optimism, an inadequate term, is the affirmation of the worth of taking a risk. For example, it is the mood of scientists and engineers involved in inner and outer space technologies, emerging nations, and urban renewers. Optimism is the capacity to see the possibilities for good in ambiguous or uncertain things. Tennyson refers to optimism as the capacity to settle on the "sunnier side of doubt."²² As a moral virtue, optimism is a treasure sought by personnel prospectors seeking leadership talent. We need optimistic people in every organization because they "make opportunities of their difficulties."²³

Courage is essential. Montaigne said "The strongest, most generous, and proudest of all virtues is true courage."²⁴ Courage takes many forms. It is a sense of duty and ambition and recognizes inaction can be as painful as action. We need the courage to deal as impersonally with our old associates and colleagues as with newly met experts and specialists. Courage on a day-to-day basis can be difficult to find, especially if we have to reject a minority opinion of an expert or a majority opinion of a group. Essential courage is needed to make a decision; buck-passing lacks moral courage and refutes responsible and efficient management. Inner satisfaction after making a decision is substantial; however, people aggrieved by our decision could rebel. Finally, it is difficult to find courage to fire, demote, withhold advancement, or shift an employee's responsibility.

Fairness, tempered by charity, is the third essential. Managers appearing to be disinterested in an employee will not be effective when the result is not charitable. Our power to make decisions should be exercised fairly and compassionately.

Conclusion

Ezra Bowen said "If Americans wish to strike a tower of ethical balance, they may need to reexamine the values society so seductively parades before them: a top job, political power, sexual allure, a penthouse or a lakefront spread, a killing on the market."²⁵ Management must approach human relations with the highest integrity. On the other hand, the "managed" must be convinced that the "managers" are honest in actions and motives. We must have faith in God, country, work, and economic and social systems, and ourselves. An ancient philosopher said "Know thyself."²⁶ Shakespeare commented: "This above all—to thine own self be true, and it must follow...thou canst not then be false to any man."²⁷ The Holy Bible contains great rules of ethics, for example: "As ye would that men should do to you, do ye also to them likewise."²⁸

Dwight D. Eisenhower, soon after leaving the presidency, wrote that "national security cannot be measured in terms of military strength alone. The relationship...between military and economic strength is intimate and indivisible." He said America needs "a fully adequate military establishment headed by men of sufficient breadth of view to recognize and sustain appropriate relationships among the moral, intellectual, economic, and military facets of our strength."²⁹

How true—even in our time.



President Dwight D. Eisenhower

Endnotes

1. *Integrity Alerts*, a booklet published by the Office of the Inspector General, Department of Defense, October 1986.
2. Quotation, attributed to Gary Edwards, The Ethics Resource Center, appeared in "A Nation of Liars," *U.S. News and World Report*, February 23, 1987. The Ethics Resource Center Inc., Washington, D.C., helps organizations formulate and implement ethical standards. The first step in conducting interviews with senior managers is to find out what values are in place. The next step is to sit down with management to draft new standards of conduct, or revise existing standards. The final step is to integrate the organization standards into training programs.
3. The *TRW Value System*, booklet, TRW Inc., Electronics and Defense Sector, December 1986.
4. *General Dynamics Standards of Business Ethics and Conduct*, booklet, General Dynamics, August 1985.
5. *Grumman Code of Business Conduct*, booklet, Grumman Aerospace Corporation, October 1986.
6. Survey by Touche Ross International of 1,082 directors and top executives of corporations with at least \$500 million in annual sales, deans of business schools, and members of the Congress, and reported in *U.S. News and World Report*, March 14, 1988.
7. Recent problems in television ministry could impact placement of clergy in future surveys.
8. Diogenes (c. 412 B.C.-c. 323 B.C.), contemporary of Aristotle, Greek philosopher, probably the founder of Cynicism, was said to have gone about Athens carrying a lantern in broad daylight in search of an honest man.
9. John Gunther (1901-1970), American journalist and author, tried to build a bridge between history and the news. His "inside" books enjoy worldwide readership.
10. John Calvin (1509-1564), French Protestant reformer, best known for doctrine of predestination and a theocratic view of state.
11. "Professional Programs: How Liberal?" *Engineering Education*, American Society for Engineering Education, Vol. 13, No. 4, November 1986.
12. Henry Cabot Lodge, Jr. (1902-1985), U.S. politician and diplomat.
13. Daniel Callahan, director, The Hastings Center, a leading medical ethics institute, former philosophy teacher and magazine editor.
14. "Code of Ethics of Engineers," approved by Engineers' Council for Professional Development, October 1, 1974.

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15. The National Management Association, founded in 1925, organization of business and industrial managers, Dayton, Ohio.
16. From presentation by Dr. Roger M. Boisjoly, Winter Annual Meeting, The American Society of Mechanical Engineers, Boston, Mass., December 1987.
17. From article by Adolph J. Ackerman, P.E., *The Institute of Electrical and Electronic Engineers Transactions*, June 1967.
18. James O'Toole, *Vanguard Management: Redesigning the Corporate Future*, Doubleday and Company, Inc., Garden City, New York, 1985, wherein he identifies "vanguard" corporations as Atlantic Richfield, Con-
- trol Data, Dayton-Hudson, John Deere, Honeywell, Levi-Strauss, Motorola, and Weyerhaeuser, and runners-up as Johnson & Johnson, Digital Equipment, Dana Corporation, TRW, Hewlett-Packard, Cummins Engine (until financial difficulties), Polaroid, and Xerox.
19. Ibid.
20. Survey, Korn/Ferry International and UCLA School of Management. Reported in *Government Executive*, April 1986, p. 10.
21. Stephen K. Bailey, "Ethics and the Public Service," *Public Administration Review*, 1965, pp. 234-243.
22. Alfred Lord Tennyson (1809-1892), English poet laureate whose works express the emotions, values,
- and aspirations of the Victorian period.
23. Vice Admiral Mansell, British Royal Navy.
24. Michel de Montaigne, *Essays*, 1580.
25. William Shakespeare (1564-1616), *Hamlet*, Act I, Scene 3.
26. Plutarch ascribes this saying to Plato.
27. Ezra Bowen, "What's Wrong," *Time*, May 25, 1987.
28. Luke 6:31.
29. Dwight David Eisenhower, *Mandate for Change*, Doubleday & Company, Inc., Garden City, New York, 1963.

ADJUSTING

(Continued from page 13)

There is also a procedure, similar to the rebasing procedure for raw inflation indices, that allows for weighted inflation indices to be expressed in terms of a new base year. The procedure consists of dividing each weighted inflation index by the raw inflation index for the new base year. Furthermore, the raw inflation index must be expressed in the same base year as the original weighted inflation indices. For example, if the set of weighted inflation indices has a base year of FY87 and we wish to shift that base year to FY88, we would need to divide each of the weighted inflation indices by the raw index for FY88 where the raw index also had a base year of FY87. The process of dividing the weighted indices by the raw index does not disturb the outlay profile.

Conclusion

In order to know which index to use, you must first determine whether the expenditures all occur within a single year or during several years. The rule for selecting the appropriate index is simple. Use a raw inflation index when expenditures occur during a single year. Use a weighted inflation index when expenditures occur during several years.

Whether your costs are expressed in base-year dollars (BY\$), constant-year dollars other than the base year (CY\$), or then-year dollars (TY\$), you can convert from one to

another by following four simple rules. By understanding how raw inflation indices and weighted inflation indices are constructed, you should better understand why these rules work.

1. To convert BY\$ to CY\$, multiply by a raw inflation index.
2. To convert CY\$ to BY\$, divide by a raw inflation index.
3. To convert BY\$ to TY\$, multiply BY\$ by a weighted inflation index.
4. To convert FY\$ to BY\$, divide TY\$ by a weighted inflation index.

References

1. AFR 173-13, Cost Analysis, U.S. Air Force Cost and Planning Factors, pp. 92, 100, 106.1.
2. *Air Force Systems Command Cost Estimating Handbook*, The Analytic Sciences Corporation, 1985.

The authors are Assistant Professors at the Air Force Institute of Technology, School of Systems and Logistics. Professor Robbins is the course director for QMT 175, Principles of Cost Analysis. Professor Murphy is the deputy department head of the Department of Quantitative Management and teaches extensively in the graduate Cost Analysis Master's Degree Program.

PMC 88-3 HEARS ABOUT ACQUISITION LOGISTICS PHASES

Vice Admiral Stanley R. Arthur, USN

You will learn to appreciate that program management of weapon systems is not a disjointed series of stages and events; it is a highly integrated set of tasks. If you retain a life-cycle management perspective as program managers, you are well along in assuring that our weapon systems are cost-effective and operationally available.

We are in the midst of fiscal restraint in all areas of weapon system acquisition. I want to discuss an area involving the majority of money eventually spent on a program—logistics support. Because emphasis at the Defense Systems Management College concerns systems acquisition, I will concentrate on the acquisition logistics phases. A strong acquisition logistics impact early in a program's life is the best means of attaining operational readiness goals while remaining cost effective. Because of this, each military service is making the logistics structure within individual program management fully equal to the engineering and contracting communities in authority, responsibility, status, training, and accountability.

To ensure that a proposed system is supportable at a high level of operational availability once introduced, the logistics design process must concurrently interface with the main design process so that trade-off can be introduced for evaluation and resource allocation. Decisions made very early in a program's life have the effect of locking-in eventual system readiness and logistics support. For example, if the design is not influenced by the logistician in the area of system diagnostics and built-in test, incidences of unnecessary

removal for inspection and replacement may be high. This diagnostics capability—if not developed because benefits were not known or the inclusion might mean that performance was lessened slightly—means increased operational logistics functioning at greater cost. It means the logistics strategy is reactive and not the consequence of having been foreseen and fairly considered in the trade-off arena. Because of this, I want you to consider the interface of logistics during the acquisition process on system supportability. As prospective program managers, you should think in terms of the costs to own and operate your system when making system alternative choices and trade-offs; not just the cost, schedule, and performance criteria.

Program affordability is a feature which will present itself more and more into your entire curriculum. Currently, in program management, questions asked early in a program's development regarding eventual logistics and supportability are becoming frequent and are determining a program's successful passage through each milestone decision point.

Affordability is important to your logistics support program. It is the budgets for items like spares, training, and ammunition which are being scaled back in order to keep up major weapon system programs. So at each of the now five major milestones, the military service review and decision structure will ask such questions as:

Vice Admiral Arthur presented the keynote address to PMC 88-3 at the Defense Systems Management College, Aug. 2, 1988. He is Deputy Chief of Naval Operations (Logistics).

—Can you afford the support as well as the hardware?

—Can you fully fund spares and other logistics elements? If not, what is the impact on readiness?

—Do the logistics plans and funding to date allow all elements of support to be present at system introduction?

—Can you show that these logistics requirements are not understated?

Your program may not survive if you don't know the answers to these support-related questions; and know them early-on! Although only a small fraction of early-milestone phase funds are spent on logistics research and development and analysis, the eventual operating and maintenance costs for a program are largely locked in by the time the program is approved for full-scale development. Cost-effective support, when the system is finally introduced, will have been determined far earlier in the process. This is even more incentive to perform logistics analysis beginning at concept exploration.

Reduced funding for all military services means competition within programs for scarce resources will intensify around official trade-off criteria lines. These criteria are cost, schedule, supportability, and performance. Priorities will be assessed continually for redistribution of resources. Too often in the past, supportability requirements were not well defended in the program office trade-off arena. This was because logistics-support requirements were not easily determined. Support was viewed as someone else's problem; specifically, someone else with an inexhaustible supply of operations and maintenance funds. Also, consequences of poor management and, subsequently, poor field and fleet support were not traceable to earlier decisions and decision-makers. None of these reasons for ignoring the resources and talent needed to establish an adequate integrated logistics support program pertain today.

During development phases, there will be greater scrutiny of your resource allocation. You will certainly be asked whether resources to achieve readiness have received the same em-

phasis as those devoted to achieving schedule and performance. You may ask yourself: "Why should I emphasize logistics and supportability from the very beginning of concept exploration? Isn't my job to field a technically adequate system, on time, and at cost? Isn't support, after all, solely up to the user?"

What tools will PMC graduates use to address logistics supportability and help shepherd the program through major milestones?

The answer is: "No." Two reasons come to mind. You should emphasize planning for support because the Milestone IV review process will focus responsibility on the program office and seek remedies to shortfalls there. It will concentrate on that program's resource sponsor. Ultimately, it is because the "effectiveness" of a system depends upon it. During this PM course, you will learn what constitutes an effective weapon system. Program effectiveness is a primary goal of program management. An effective system is, by definition, *capable, dependable, and available*. All efforts toward logistics supportability are directed toward making a system available to the commander when called upon at random.

As an example of the impact of availability, take any missile, which must be *capable* to destroy its target and *dependable* during its flight and targeting. That is part of program effectiveness; however, the missile must

also be *available* when called on if the entire system is to be all-effective. What differences will it make to the commanding officer in the field to have a capable and dependable missile if it is not available? The program manager, since "Day One" of the program, should have structured and guided an integrated logistics support program toward a high level of missile system availability. You will find the acquisition process is geared increasingly to making life hard for any program manager whose plans are not sensitive to just such a life-cycle approach, and to the resources needed to establish and maintain operational availability.

Let's assume we are dealing with PMC graduates. What tools will he or she use to address logistics supportability and help shepherd the program through major milestones?

Assigning an integrated logistics support manager at program initiation is an important first step. Currently, each service is developing a cadre of professional senior logistics managers to coordinate development of each of the 10 Integrated Logistics Support elements. Intern programs begin this process by maintaining uniformly high standards of curriculum and rotational assignments. Too often within program management, short tours of duty in procurement and a lack of logistics training result in a program manager oriented toward short-term results, as opposed to the long-term perspective required for a logically supportable program. For this reason alone, a senior logistics manager must be assigned, and be equal in rank, grade, and responsibility to other acquisition professionals within the program office. Similarly, the senior logistics manager for prime contractors, with whom we conduct business, should reflect this same parity and level of influence within each management hierarchy as a result of contract provisions we impose.

Since readiness is a priority equal to performance, the evolving design must be influenced by logistics considerations. The logistics manager will coordinate a logistics support analysis to parallel the design effort so that long-term supportability impacts are recog-

nized for program manager trade-off purposes. Similarly, the senior logistics manager will maintain a logistics funding and requirements document to justify logistics costs. The program manager should assure visibility of contractor logistics costs via the contract's work breakdown structure reporting and monitoring system.

Another program manager tool coordinated by the logistics manager is Computer-Aided Acquisition and Logistics Support, (CALS). This is a Department of Defense initiative now required for all acquisition programs. The CALS integrates all design data with logistics data. It will standardize and accelerate the automation of technical data and allow each program to receive, distribute, and use acquisition and logistics technical information in digital form.

Acquisition strategies strongly affect the way a logistics program evolves. Your emphasis during this course at the Defense Systems Management College will be traditional research and development programs; however, becoming more prevalent by direction are rapid acquisition strategies. Buying a system off-the-shelf, or by rapid prototyping, or as a Non-developmental Item is a legitimate result of acquisition streamlining initiatives to reduce paperwork and contract specifications. I will refer to these strategies generically as Non-developmental Item (NDI) programs.

The NDI and other rapid acquisition solutions, by their nature, shift program risk primarily to the area of supportability. The hardware, after all, is known, as is the cost to acquire it and the schedule for delivery. Since the system was not designed for the particular use intended, the program manager must take care that it can be integrated into the operational and maintenance environment. Logistics questions associated with off-the-shelf procurements are: Is the system too sophisticated to operate and maintain by current personnel? Can we transition to organic support versus contractor support without decreasing readiness or increasing maintenance costs?

Once the NDI off-the-shelf solution is considered, extra attention is needed

to determine how to integrate it into our service operating and maintenance system since the remaining unknowns are here. The cost and ability to integrate has been taken for granted too often in the rush for a simple and quick solution. Before you commit to an NDI solution, make sure the training, supply, and maintenance communities know what is coming so that the system is supported at introduction.

I have discussed logistics support planning and design interface from Concept Exploration through Production Milestone phases. One critical area remains; that is, the readiness measurement of systems which have been introduced. It is the responsibility of the logistics community to determine if the anticipated levels of readiness, availability, and mission capability are being met. The entire logistics support program should have been geared toward meeting and sustaining a certain operational availability threshold. Milestones IV and V have been established to assist the logistics community in measuring readiness and providing a milestone decision forum where remedies can be identified and tasked for action.

Milestones IV and V reviews and decision meetings, conducted a year or two after introduction, will serve several purposes and have several benefits.

—One is a greater impetus to improve the means of measuring readiness. Readiness measurement techniques will become more uniform and objective. They will have to be since the results will be used as rationale for allocating additional resources to fix problems and as lessons learned for new development efforts. Currently, a logistics manager faced with budget cuts which will adversely impact readiness years from now, does not have a strong data base of how similar cuts to other systems during early development had definite and measurable readiness impacts in the out-years. Program managers know this, and have found easy targets in the logistics manager's budget; however, the audit function and decision forum associated with Milestones IV and V will clearly document the effects of imprudent program management regarding logistics.

These lessons-learned readiness measurement documents will serve as budget justification for future programs and their funding allocation trade-off exercises.

—Accountability will be another consequence of Milestones IV and V reviews which will impact the program management approach to logistics planning and funding. The levels of readiness and availability actually attained in the field, and as promised by the program manager as he allocated levels of logistics funding, will be scrutinized. If the program manager claimed "no adverse impact to future readiness" as he cut the logistics program and its budget, and it was later found during Milestones IV and V that readiness is significantly lower than required of the program manager through the early requirement documents process, then responsibility must be assessed. This is more easily accomplished as more objective measures of readiness measurement are implemented. The Milestones IV and V decision points for a program, having been audited for logistics supportability and for levels of readiness, will target a program office and/or the program's sponsor for funding remedies if the result of poor levels of support and readiness found are shown to have been caused by too cavalier an approach toward the logistics support program from the beginning of Milestone I.

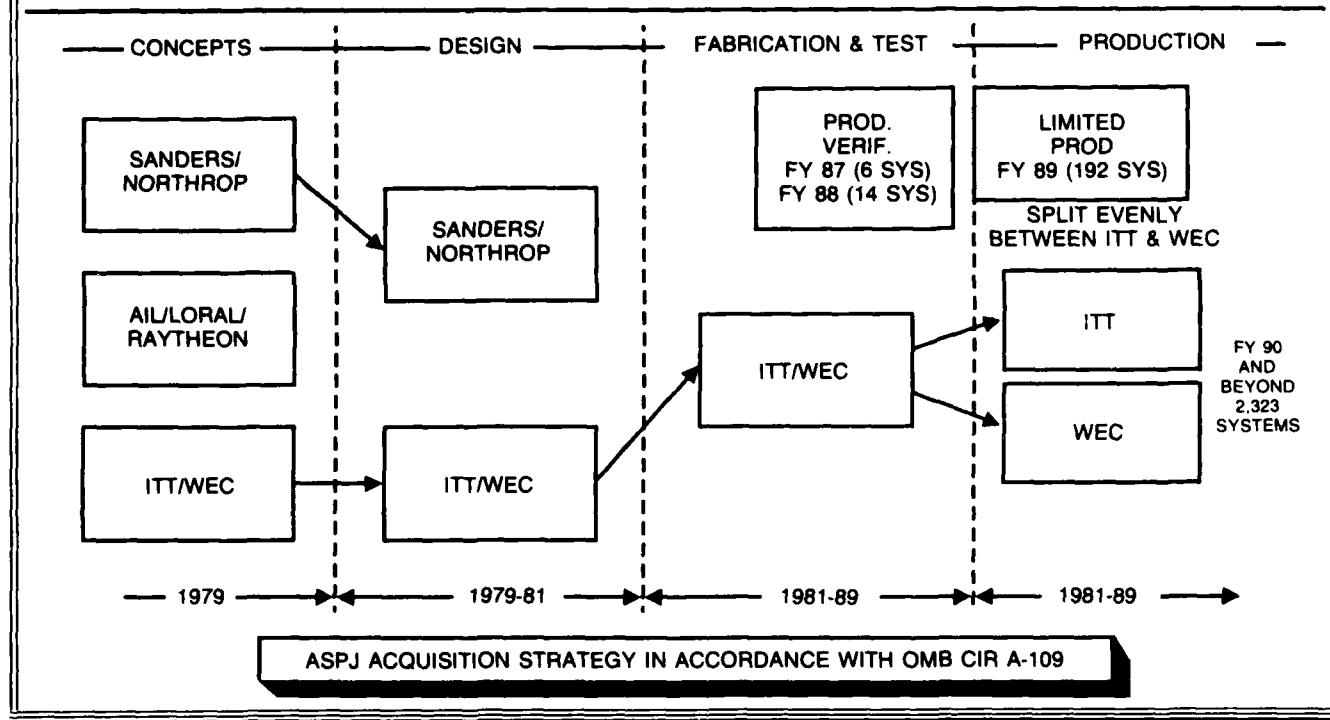
The early and diligent pursuit of cost-effective logistics is necessary for a program's survival at each milestone decision point, including the new logistics-related Milestones IV and V. A senior logistics manager is indispensable in guiding early logistics analysis for design influence purposes, for justifying the cost of developing a logistics program, and for making the program manager look good as the acquisition program is measured more and more in view of the logistics support acquisition portion throughout the five milestones.

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JOINT SERVICE/JOINT VENTURE: A MANAGEMENT CHALLENGE

Captain A. E. Victor, USN

Figure 1. MAXIMIZE COMPETITION ASPJ JOINT VENTURE STRATEGY



A joint venture, joint service program equates to a major management challenge. The Navy/Air Force, ITT/Westinghouse team has accepted that challenge in the past several years and, despite technical and programmatic problems, brought the program to a point where we could take the first step toward production transition.

The purpose of this article is to discuss briefly the management challenge of the Airborne Self Protection Jammer (ASPJ), specifically with regard to the joint-venture concept, and to offer an outline of lessons learned for future reference.

I will review the experience of the joint venture (JV) strategy since award of the full-scale development (FSD) contract in August 1981. I want to highlight the idea of introducing a production verification phase as a program milestone while the program proceeds toward full production. I will not discuss the joint-service aspect of the program in detail; the joint-service management challenge warrants a separate article.

What Is the Airborne Self Protection Jammer?

The Airborne Self Protection Jammer program objective is to provide a common self-protection jammer system for Navy and Air Force tactical aircraft. The program is acquisition category I (ACAT I) with a value of \$570 million in Research Development, Test and Evaluation and \$5.5 billion in production. The Navy is the executive service. The user aircraft are the F/A-18, F-16, F-14, A-6 and AV-8B. The Airborne Self Protection Jammer is a state-of-the-art jammer system with the capability to handle a broad frequency range of different types of radar emitters. The basis of the Airborne Self Protection Jammer concept was derived from the wideband dual mode concept of the early 1970s. Wideband refers to the wideband of frequency operation of Airborne Self Protection Jammer. Dual mode refers to the ability of Airborne Self Protection Jammer to transmit two types of electromagnetic energy, pulse and continuous wave (CW). The major technical challenge for the Airborne Self Protection Jammer team was to house a system in a volume of 2.3 ft³ that has a pulse, continuous wave and pulse doppler

RF capability over the entire RF spectrum of interest and inherently has the software flexibility to enable it to be changed with the emerging threat. The 2.3ft³ was driven by the requirement for the Airborne Self Protection Jammer to be retrofitted in the existing space available in the F/A-18 which currently houses the ALQ-126B.

The volume requirement was achieved by dividing the Airborne Self Protection Jammer system into six different weapon replaceable units/line replaceable units (WRAs/LRUs); i.e., two transmitters, two receivers, a computer and an augmentation receiver. The same identical WRAs are used in every application of the Air Self Protection Jammer system; hence, total hardware and software commonality has been achieved. The aircraft interface is achieved through a rack unique to each aircraft. The racks represented a significant technical challenge. There are variations in the application of the basic Airborne Self Protection Jammer system. In some of the aircraft applications, there is a requirement to provide additional self-protection coverage aft of the aircraft; in these cases, one or two transmitters are added to the aft Airborne Self Protection Jammer suite. The aft transmitters are identical to those used in the basic system. The fore and aft systems are tied together with the augmentation receiver. Hence, the six unique weapon replaceable units can be used in various combinations to adapt to a particular aircraft requirement. The original 2.3ft³/250 lb. requirement is achieved with the five basic weapon replaceable units/line replaceable units. The sixth WRA is used with additional transmitters in the aft section of the F-14, F-16 and A-6 aircraft. In every case, the same weapon replaceable unit building blocks are used and are completely interchangeable between aircraft.

Acquisition Strategy

The Airborne Self Protection Jammer dual development acquisition strategy was formulated during the concept phase of the program in 1975. The strategy is displayed in Figure 1 and, theoretically, is simple. The fundamental premise was to foster com-

petition throughout the life of the program with the goal to qualify at least two contractors who would compete on an annual basis for the majority of the production requirements.

The fundamental premise was to foster competition throughout the life of the program with the goal to qualify at least two contractors who would compete on an annual basis for the majority of the production requirements.

During the concept phase, three teams of contractors completed their "paper" design which was to demonstrate during the subsequent design validation phase. The companies that teamed together generally tried to take advantage of their complementary technical strengths. Other considerations were business base and each company's long-range objectives.

Two teams were selected in 1979 for the 17-month demonstration/validation phase, when primary efforts were directed at risk reduction and proof of design. Much of the risk was directly linked to the volume constraint. Examples of some risk areas are as follows:

— Miniaturization of microwave components like fabrication of complex hybrid circuits. A hybrid is a miniature electronic circuit comprising 20-30 semiconductor and discrete electronic components to achieve a specific function. All the elements that comprise a hybrid are housed in a small, usually 1x1 inch case, that is hermetically sealed.

- High voltage power supply.
- Fabrication of the dual mode transmitters like housing and operating a continuous wave and pulsed traveling wave tube (TWT) in the same weapon replaceable units.
- Hardware/Software integration.
- Traveling Wave Tube Design.

In 1981, the ITT/Westinghouse team won the dem/val competition for the full-scale development of 16 Airborne Self Protection Jammer systems. The full-scale development phase was to last for 37 months. Technical problems, described later, considerably protracted the full-scale development phase, led to contract renegotiation, and reduced the number of full-scale development systems from 16 to 12. The last caused the full-scale development program to be asset poor, which has caused delays due to associated schedule problems. In addition, subsequent to the award of the full-scale development contract, the program was influenced significantly by a factor that historically has plagued the development of EW equipment; i.e., the constantly changing threat environment. The emergence of highly sophisticated radar weapons systems in the early 1980s led to the requirement to incorporate a major change in the design of the Airborne Self Protection Jammer system after the full-scale development contract was awarded. Although details of this requirement are classified, the basis of the change required the introduction of a Digital Radio Frequency Memory (DRFM) device, which compounded our volume constraints and significantly complicated the hardware/software relationship.

Traveling Wave Tube Risk Reduction

A noteworthy risk reduction effort for the Airborne Self Protection Jammer program was in the area of traveling wave tubes. The Airborne Self Protection Jammer uses four different types; two pulse and two continuous wave tubes in each basic system. Two or four additional tubes (one or more of the original four) are used in the augmented system. The in-

itial design estimates for the Airborne Self Protection Jammer revealed that the traveling wave tubes represented about 40 percent of the reliability and 25 percent of the cost of the system. By doubling the reliability of the traveling wave tubes, approximately \$300 million in life-cycle costs could be saved. Our current estimates are that approximately 20,000 traveling wave tubes will be required for Airborne Self Protection Jammer production.

Given this situation, in 1982 the Airborne Self Protection Jammer program office initiated a reliability producibility enhancement (RPE) program for the traveling wave tubes. The government provided the joint venture with \$2 million to establish the first of two phases of the program. The joint venture was required to establish, via competition, a separate source for each tube type and to require demonstrable reliability and producibility improvements. Two years later, an additional \$2 million was provided to the joint venture to obtain second sources for these tubes under the same ground rules.

To supplement the reliability producibility enhancement efforts, in 1987 we were successful in establishing a pilot production line for each of the four traveling wave tubes using Title III funding. This type of funding is appropriated specifically for the improvement of the industrial base. Once again, four contracts were competitively awarded, one for each tube type. Each contractor will build about 60 tubes which will be available in the government inventory to be used in the Airborne Self Protection Jammer production contracts.

To date, we have seen improvement in the traveling wave tube performance compared to previous systems. During full-scale development, our average mean time between failures has been 3,300 hours. The traditional culprit of EW programs has not been a problem for the Airborne Self Protection Jammer.

Technical Problems

The Airborne Self Protection Jammer full-scale development contract stipulated an 18-month schedule for delivery of the first prototype. For a

system as complex as the Airborne Self Protection Jammer, the schedule was unrealistic even with the amount of risk reduction that preceded it. The government and the contractor should share criticism for signing up to such an overly ambitious schedule; however, it was a result of what the budget and political environments would tolerate. Later, I will describe how we tried to avoid this pitfall in our production transition acquisition strategy.

Achievement of the full-scale development schedule was obstructed by technical problems during the first 3 years of development.

Achievement of the full-scale development schedule was obstructed by technical problems during the first 3 years of development. These can be categorized broadly as follows:

- Requirement for a thermal redesign
- Redesign of 11 of the 224 hybrids used in the system
- Hardware/Software integration
- Unreliable high voltage and low voltage power supplies.

The first two problems were a direct result of the Airborne Self Protection Jammer volume constraints. The first attempt to house the system in 2.3 ft³ resulted in a poor thermal design and the inability to include all the required components in the computer (WRA-3). This required the redesign of 12 of the 48 shop replaceable assemblies/shop replacement units (SRAs/SRUs), like the printed wiring board assemblies. When done, the first prototype unit was delivered to the government about 1 year later.

When delivered, the first 2 systems did not perform in accordance with the specification. Subsequent investigation determined that 11 hybrid circuits required redesign. The Airborne Self Protection Jammer full-scale development systems utilize 224 hybrids comprising 125 different types. Utilization of hybrids represented one of the major technical risk areas that are underestimated significantly in the initial Airborne Self Protection Jammer assessment. Hybrids had to be used in the Airborne Self Protection Jammer to allow the required volume reduction. The Airborne Self Protection Jammer and the ALR-67 used the same central processing unit (CPU), the ATAC 16M. The ALR-67 CPU is a standard 6"x9" multilayered board, whereas the same capability exists for the ASPJ ATAC-16M in a 2"x2" hybrid. The risk associated with hybrids was the limited industrial capability in the 1979-82 time frame to build hybrids with a high yield and the significant turnaround time (9-12 months) to redesign, fabricate and test hybrids once a problem was found. The combination of the thermal and hybrid redesign extended the Airborne Self Protection Jammer program schedule about 2 years and led to an associated cost growth. To limit government liability against further problems, we required the contractor to accept a renegotiated ceiling or "CAP" on the full-scale development contract. Although absolutely necessary to protect the program, the capped contract represented the nadir of the Airborne Self Protection Jammer program and the government/contractor relationship.

The third problem developed under the contract cap. Lack of comprehensive hardware/software integration between the joint-venture partners was first recognized when a system was delivered to the government's primary field activity, the Pacific Missile Test Center (PMTC). The joint-venture partners had not communicated sufficiently with each other during development and neither had an in-house EW simulator that could properly test the entire system. This situation was clearly a result of the lack of a unified joint-venture management structure. Each

partner concentrated on a "piece of the pie" and did not have a substantive appreciation of the other's progress.

Although the contractor was under the capped contract at the time, the government and contractor realized this had to be rectified quickly and a significant team effort was accomplished during a 6-month period in late 1985/early 1986. Within 6 months, positive laboratory results were achieved which demonstrated the Airborne Self Protection Jammer capability to handle the type of threat environment for which it is designed.

The nemesis of almost all avionics programs—power supplies—became apparent during the initial environmental and reliability tests in early 1986. Although recognized early in the program as a high-risk area, the risk reduction efforts were not enough. Primary problems with the power supply were in the quality of the fabrication and the constrained volume; the latter aggravated the inherent problem of eliminating paths for arcing, particularly in the high-voltage sections. To solve this problem, a government independent technical review team was established to review thoroughly the fundamental design and the fabrication techniques used. This resulted in several changes in quality, process and design. Subsequently, the power supply performance and reliability did improve; however, because of significant problems with power supplies, the government required the contractor to provide a second source with an independent design during the production transition phase. The primary lesson learned here was: Neither the contractor nor the government paid enough attention to what was considered a routine technical problem. Although some environmental stress screening of components was performed, it was not enough to detect problems that occurred in the system environmental test. The contractor, too busy dealing with other parts of the system that were considered state-of-the-art, got stung badly.

As these problems were being solved, the thrust of the Airborne Self Protection Jammer program was

gradually being reversed from an extremely poor technical situation to one in which we were able to demonstrate successfully, in both F-16/F-18 flight test and laboratory testing, the significant capability of Airborne Self Protection Jammer.

The lessons learned as a result were: The initial rates were too high in view of the problems and demands of production transition. The rate problem was compounded by an unrealistic schedule to first delivery.

Production Verification (PV)

In the midst of solving our technical problems during 1984-85, I reviewed the feasibility of our original production transition plan which was to use the full-scale development design as the basis for rate production. The Director of reliability, maintainability, and quality assurance, OASN (S&L), Mr. Willoughby, in trying to improve the production transition process, stimulated our careful review of the history of other DECM equipments. In every case, there were significant differences in planned (contracted) and actual production rates. We categorized the problems associated with the risk of production transition into several areas as follows:

—The need to incorporate producibility changes. The full-scale development avionics equipment is constructed to allow flexibility for design changes; thus incorporating wire bundles, connectors, wire-jumpers, etc., that need to be replaced with more easily produced hardware.

—The need to develop and fabricate the factory test equipment that is to be used on the production line. During full-scale development, the system is constructed and repaired in an engineering rather than a manufacturing environment. Qualification of factory test equipment while simultaneously going to rate production presents the contractor with a situation of constant turmoil, induces delay and raises questions regarding true performance.

—Establishment of a multisource contractor base requires significant lead time to prepare the production specifications and to select multisource contractors. Again, this cannot be done during a rate production environment.

—Lay out of the manufacturing floor to ensure efficient production flow is required. The contractor needs enough time to experiment with the manufacturing setup and correct problems in a low stress, (low production rate) environment.

—Ensuring that critical process controls are established for high yields, like hybrids and solder cleanliness.

—Creating a manufacturing organization integrated with full-scale development systems engineers.

Another aspect of past programs reviewed was to compare the contractual and actual production rates of the first two or three production lots. Characteristically, each program analyzed exhibited significant variance between the two rates with the actual rate being woefully behind what the government initially required. The lessons learned as a result were:

—The initial rates were too high in view of the problems and demands of production transition.

—The rate problem was compounded by an unrealistic schedule to first delivery.

This exercise led us to choose our initial production rates to be below the actuals for the equipments that were studied. In addition, the lead time to first delivery was chosen to be 26 months, which is considerably more realistic than what has been required in the past; i.e., 18-20 months.

Once the low-rate, product verification contract is well underway, we plan to award the subsequent limited production contract as a directed 50/50 split to each of the joint-venture partners; i.e., two separate contracts. The award of this contract will be dependent on successful test results during initial operational test and evaluation (IOT&E). During limited production, each contractor will build and deliver Airborne Self Protection Jammer systems independently and gradually build up from two systems each per month, to thirteen systems each per month. During the evolution of the product verification and LIM-PROD contracts, each contractor will build a subvendor base. The general requirement is that all subcomponents of the Airborne Self Protection Jammer must have two or more suppliers. Subsequent to the LIMPROD contract and a successful OPEVAL, the two contractors will compete for the remainder of the production lots on an annual basis. Having gone through the gradual buildup and production learning curve, each company should be able to produce 22 systems/month with a projected surge capability of at least 30 systems/month. This translates to about 130 to 180 weapon replacement units per month per contractor.

In addition to the above areas which are problems/risk areas common to any production transition effort, the ITT/WEC joint-venture team needed to have a pragmatic approach to transfer their individual technical expertise to each other. During full-scale development, each contractor built only part of the entire Airborne Self Protection Jammer system. In general, ITT built the transmitters, WEC the receivers and shared the building of the computer.

To ensure that each company could build the entire Airborne Self Protection Jammer system and that they are interchangeable in form, fit, or function, a period of time was required to allow for the technical transfer and interchangeability demonstration. The result was the requirement to establish a phase in the program to reduce the risk of production transition; i.e., a product verification phase. A key re-

quirement to effect the product verification and subsequent production contracts was to tie the contractual events to a set of test criteria that had to be met before contract award.

Production Verification Contract

The Airborne Self Protection Jammer production verification contract was awarded to the Joint Venture in August 1987. The contract requires that 20 systems be built in the low-rate production environment with the last four systems to be built independently; i.e., two each, by each of the joint-venture partners.

Main objectives of the production verification contract are to reduce the risk in all the areas cited above. Specifically the following general tasks will be accomplished:

- The technology transfer between the joint-venture partners
- The incorporation of producibility enhancements to enable more efficient manufacturing of the Airborne Self Protection Jammer and to improve reliability
- Building and testing of the factor test equipment
- The incorporation of corrections to the performance deficiencies found during full-scale development testing
- To incorporate some performance enhancements that are driven by the emerging modern threat
- To establish the multisource vendor base.

In addition to what I have described, other important features of the product verification contract are:

- The requirement for a detailed cross manufacturing plan (discussion in more detail later).
- The requirement for contractor investment in factory test equipment (FTE). A clause in the product verification contract required the joint-venture partners to collectively buy the factory test equipment as they proceeded through the first three contracts. The government guaranteed the contractor certain protection clauses in the event of cancellation. Also, the government agreed to reimburse the contractor for

investment during the first five production lots. The primary benefit of this clause is to incentivize the joint-venture contractors to approach the factory test equipment problem collectively and to encourage them to be efficient in their acquisition.

—The establishment of a not-to-exceed (NTE) unit cost on the follow-on LIM-PROD contract. Joint-venture contractors agreed to the not-to-exceed unit cost based on the government buying 150-210 systems during this contract. Major advantage of this clause was to cap the unit cost in the non-competitive environment of the directed 50/50 split which, in turn, should set up the cost-learning curve for the remainder of the production run.

The success of the product verification strategy is critically dependent on a comprehensive cross manufacturing plan. The plan needs to be based on the fundamental agreement between the two companies to have a completely open exchange between them.

Cross Manufacturing Plan

The success of the product verification strategy is critically dependent on a comprehensive cross manufacturing plan. The plan needs to be based on the fundamental agreement between the two companies to have a completely open exchange between them. The ITT/WEC joint venture has committed to such an environment and this attitude is reflected in their establish-

ment and implementation of their cross manufacturing plan. The plan covers every aspect of the product verification buildup from the initial design engineering to manufacturing, and includes mutual assurances of process control, material procurement and drawing exchanges. The key features of this plan are as follows:

—A logical division of tasks based on their full-scale development experience. From this, a leader/follower concept was developed for each of these tasks.

—Each company will establish teams of engineers in each other's plant during the product verification buildup.

—The joint-venture design teams (technology transfer teams) must ensure production/facility compatibility in both plants prior to drawing release.

—Both partners must sign off on originator drawings.

—The lead company for a given task negotiates the material buy for both companies for the product verification lot.

—For any change in design, the originator must supply associated materials to the partner.

—The lead in each task is responsible for first unit test.

—The establishment of a joint-venture configuration control board, an extension of the full-scale development effort.

—Establishment of a critical material committee.

—Joint Design Reviews.

—Joint distribution of revision notices.

—Manufacturing engineering co-located with design engineering.

—A single master set of drawings made in one government approved format.

—Full documentation exchange emphasizing differences in each company's operation to avoid incompatibilities in manufacturing approach.

—Interchangeability testing once each company builds its units independently.

Summary

The joint-venture concept is a useful method toward achieving production competition. It is one of several ways to achieve the competition goals and must be tailored for a specific requirement. The prime requisites are that a system must be sufficiently complex to warrant two contractors' expertise, the production buy must be large enough to achieve an economic buy for each contractor and, fundamentally, contractors need to establish a mutual trust to ensure an open relationship throughout the design and production transition process. The initial cost of the joint-venture approach will be higher than that of a single development contractor but, assuming production competition will be required, that cost will be offset by avoidance of the cost necessary to establish a follower in the traditional leader/follower method.

Another advantage of the joint-venture approach is that the partners are truly dependent on each other to get through the development and production transition process. This results in a better opportunity to ensure two viable competitors for the life of the production run. From a management standpoint, a joint venture is difficult since it requires a mutual understanding and knowledge of the details of each other's technical approach to ensure hardware/software interoperability. Financially, each company needs to agree on the division of resources and liability for cost growths. Key players within each company are the program managers—they must have exceptional rapport with each other and be able to provide direction to lowest levels while having ready access to highest levels of their respective organizations. Cost/Schedule control between the two companies is probably one of the most difficult areas. The same scheduling system needs to be used for both.

Finally, the use of a separate production verification process to transition from full-scale development to production is the most logical step for any complex avionics system. The effort is

well underway with the Avionics Self Protection Jammer. Although we have a long way to go before we can be certain of the payoff, our past experiences with avionics systems suggest that inserting a product-verification phase before limited production is a prudent thing to do and will pay off in a timely rate production and reduced logistics support once the system is fielded.

JOINT VENTURE LESSONS LEARNED

1. Select a contractor team with a proven track record. Beware of strong/weak team. Up front, each company must break down the traditional "proprietary" barriers and form a strong management/technical team. This needs to be a corporate commitment that is executed by strong but mutually compatible program managers.

2. A separate program office is required that is manned by both companies. The joint-venture program manager/deputy program manager need to manage cost/schedule performance of the combined project. If the two program managers are not collocated each will concentrate primarily on their parent company's activities.

3. Contractually, joint venture contractors must be jointly and severally liable. This will make one contractor be as liable and responsible as the other contractor for problems that arise.

4. There must be a real-time joint venture cost schedule control system in place that is managed not by each individual partner but by the joint-venture project office. Even if both contractors are (CS)² qualified, their individual systems need to be tailored to provide a meaningful Joint Venture (CS)² system.

5. Both the contractors and the government need to start detailed cost estimates as early as possible; i.e., during the conceptual phase of a program. The joint-venture structure makes cost estimating more difficult than with a single contractor. The best way to obtain the initial cost estimates is to use actual costs from a program in each company of similar technology

that is in production. The next step is to track closely the full-scale development costs.

6. Ensure that each contractor has or plans to have adequate production capacity. Review existing and future workload. Determine if capital investment is required.

—Software/Hardware Teams must be collocated; i.e., form, fit function interface is not enough. Each company's engineers need to go through the design and troubleshooting of each subassembly and each software module to really understand the entire system.

—Frequent joint-venture government design reviews by qualified technical specialists during the entire buildup process are mandatory.

—The government should have full-time, dedicated, on-site hardware and software engineers at each contractor's plant throughout the development and production transition stages.

7. Ensure that both companies have their engineering, software programming and manufacturing personnel involved from the initial design through production transition.

8. There is a maximum incentive to perform if each contractor only builds part of the system. The contractors must rely on each other to transfer their technical knowledge and to ensure a mutually acceptable cross-manufacturing arrangement. This will foster competition in the long-run as long as the government does not change its acquisition strategy to compete.

9. A realistic (demonstrated) risk reduction program must be performed during DEM/VAL by both contractors. Breadboard demos are insufficient. Need to demonstrate form, fit function with representative hardware and software to ensure the complexities of the design are fully understood. It is imperative that risk reduction be maximized during DEMO/VAL and not later. Additional schedule during DEMO/VAL will save schedule later.

10. Use critical independent assessments during DEMO/VAL to avoid surprises later.

11. To reduce schedule risk during full-scale development, the joint venture must demonstrate the hardware and software integration of their respective subassemblies several months in advance of the first delivery.

12. For critical areas/high risk areas the joint venture should be required to develop multisources during DEMO/VAL, e.g., traveling wave tubes.

13. The joint venture must have the capability to demonstrate system effectiveness, as opposed to electrical performance. Checking the electrical performance parameters is not enough. The contractor must be required to demonstrate at least a representative mission capability.

14. Memoranda of Agreement are essential between services, between partners of the joint venture, and between the Defense Contract Audit Services. The differences in the procedures used by AFPRO/NAVPRO/DCAS organizations are not conducive to a joint-venture operation. The AFPRO/NAVPRO/DCASPRO MOA must recognize the joint-venture relationship to allow expeditious transfer of hardware between the two companies during full-scale development. Normal transfer procedures unnecessarily delay the exchange of equipment between the two companies.

15. A joint-venture configuration management team must be set up during full-scale development and strictly monitored. All software/hardware configuration changes must be controlled as a joint venture. The government must have a system to track the configuration and the location of all parts at least to the shop replaceable assembly level. The government must establish the capability to track software trouble reports of both companies.

16. Each joint-venture partner must be willing to use resources to overcome a problem of its partner. The two part-

ners should not allow a problem that is being experienced by one to progress to the point of disaster until the second partner becomes involved. This sounds like common sense, but the situation has occurred several times in the Aviation Self Protection Jammer.

17. For a subsystem such as the Aviation Self Protection Jammer, at least one of the partners must have proven experience in platform integration or should contract with someone who does. The government must ensure this in its initial contract.

18. A joint venture logistics team must be established during the DEM/VAL phase. The joint venture must designate a single manager for reliability, maintainability and logistics to ensure that a compatible program in these three supportability disciplines is effected.

Captain Victor is Project Manager, Advance Tactical Aircraft Manager, Airborne Self Protection Jammer System, Naval Air Systems Command.

INTERIM COMPETITION ADVOCATE GENERAL

Secretary of the Army John O. Marsh, Jr., has announced the interim appointment of Kenneth J. Loehr as Acting Competition Advocate General. Mr. Loehr, the Army's second Competition Advocate, succeeds Major General Charles R. Henry, who is Deputy Director for Acquisition Management, Defense Logistic Agency. Mr. Loehr, Senior Executive Service, was Chief of the Contract Policy and Procedures Division, Office of the Assistant Secretary of the Army (Research, Development Acquisition).

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